Volatility of farm incomes, prices and yields in the European Union

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H.C.J. Vrolijk
C.J.A.M. de Bont
H.B. van der Veen
J.H. Wisman
K.J. Poppe

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Vrolijk, H.C.J., C.J.A.M. de Bont, H.B. van der Veen, J.H. Wisman and K.J. Poppe

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The interest in the volatility in farm incomes is stimulated by the development of the CAP. Prices of products such as cereals, milk and beef will not be protected and stabilised by the CAP in the future. This report analyses the reasons and development of volatility of incomes in agriculture in the European Union. Developments are analysed per type of farm as well as per member state, and for the main production regions. Specific examples such as animal diseases and periods of drought are reasons for income fluctuations and receive special attention in this report.

Door de ontwikkeling van het GLB wordt er steeds meer aandacht besteed aan de volatiliteit van het inkomen van boerenbedrijven. De prijs van producten zoals granen, melk en rundvlees zal in de toekomst niet meer worden beschermd en gestabiliseerd door het GLB. In dit rapport analyseren we de oorzaken en de ontwikkeling van de volatiliteit van de landbouwinkomens in de Europese Unie. De ontwikkelingen worden per type boerenbedrijf, per lidstaat en voor de voornaamste productieregio's geanalyseerd. In dit rapport wordt speciale aandacht besteed aan specifieke voorbeelden, zoals dierziekten en perioden van droogte, die een oorzaak zijn van de fluctuaties in het inkomen.

Orders

+31.70-3358330
publicatie.lei@wur.nl

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Preface

Risk management and income volatility in agriculture is a topic of increasing interest for farmers as well as for policy makers. The design and economic impact of risk management tools was the central focus of the European research project on 'Income stabilisation in European agriculture'. This report provides an empirical analysis of the income volatility and income crises in the European Union.

We gratefully acknowledge the financial support from the European Commission, under the European Union's Sixth Framework Programme for Research and Technological development. We also like to thank the members of the Steering Committee and other national and international project partners for their comments and suggestions during the course of this project.

Prof. Dr R.B.M. Huirne
General Director LEI Wageningen UR

Summary

Introduction

The objective of this report is to develop an understanding on the volatility in farm incomes. More specifically the objectives are: to analyse individual farm data with respect to price, production and farm income (FADN); to complete farm analyses with data on farm households, where possible (OECD, ERS); to provide full insight into the price, production and income distributions including downside risk and to make a clear distinction between normal income fluctuations and income crises. In the analyses use is made of the European Farm Accountancy Data Network (FADN). FADN consists of data of approximately 60,000 holdings, representing some 4 million farms in the European Union (15). Data are used of the years 1990 to 2003. In the analyses the main indicators are Family farm income, labour input (respectively family and hired labour), farm size (in European size units), revenues (including subsidies) and costs, with a distinction between overhead costs, depreciation, interest costs, rent, labour costs and direct costs.

Two important indicators are used to answer the research questions: the yearly trend and the volatility. The trend is the average yearly change accounted on the base of the average of the first 3 years (1990-1992) and the average of the last three years (2001-2003). The volatility is the average yearly deviation from the trend.

Instability of agricultural markets and fluctuations of the prices received by farmers are major reasons for the volatility of incomes in the farm sector. The analyses in chapters 4 to 12 of this report per type of farm show some interesting aspects of this.

Differences between types of farms

The volatility of income (given the average incomes per year per member state) in some sectors is larger than in others. For instance dairy farmers have in general a more stable income than for instance pig farmers. A major reason for this is the stabilisation of dairy, or milk, prices by the CAP. The CAP does not manage the pig market in a way that prices are not fluctuating. The reform of the CAP, with a dismantling of the systems of price stability, may lead to a smaller difference between types of farms.

Another reason for differences in volatility between types of farms is the dependency on some specific inputs: for example compound feeds on the special-

ised pig and poultry farms, energy on horticulture firms producing in greenhouses. Fluctuations in prices of these inputs may result in a larger change in income on the types of farm mentioned than on other types, as for instance grazing livestock farms or field crop farms.

Besides that, differences in volatility between types of farms are caused by the margin of income: the returns of products diminished with costs paid (and including depreciation) as a percentage of the returns. In general the more specialised larger farms (often with salaried employees) have a smaller income margin than the 'traditional family farms'. Farms with a substantial amount of labour can for example be found in horticulture and in the granivore sector. Such larger farms with small margins have a larger volatility in their incomes than the smaller farms.

Structural changes in agriculture and on the markets

The volatility in incomes in agriculture will increase over the years. Some important reasons for this conclusion are:

- *the dismantling of the CAP*
  Prices of products such as cereals, milk and beef will not be protected and stabilised by the CAP in the future. Prices of these products may show larger fluctuations than in the past. Fluctuations in prices will result in a (larger) volatility of incomes of a large group of farmers, which are specialised in field crops, dairy, other grazing livestock and mixed farms with these products. In most member countries these types of farms are (still) the majority of the farming population (chapter 4, table 4.2);
- *increased productivity and scale of production*
  Given the character of the markets of farm products and the impact of many other factors on the sector (see chapter 3), farmers are increasing their productivity and their scale of production. Larger amounts of investments are necessary to achieve this. The income margin per unit of product is decreasing, partly because farm prices do not follow the general development of prices (inflation): Prices of farm products in real terms will become lower, as was the case in the past.

Growing differences and risks on incomes in a dynamic sector

The developments, described in the chapters 4 to 12 of this report per type of farm, show a strong change in the structure of the sector in the period 1990-2003. Many farms have disappeared, because farmers stopped their activities and had no successors. On the other hand: other farms expanded. They use the

production factors and especially the land of the farmers who left the sector. For most products, productivity gains resulted in an increase of production volume, keeping prices of farm products at a low level.

There are reasons - amongst others the CAP Reform, the enlargement of the EU, the results of WTO negotiations, productivity gains as a result of new technologies - to expect at least a comparable shift in the farm structure in the years ahead. The general trends are: (1) each year some 3% of farms 'leave the sector' (on these farms older farmers have no successors) and (2) a rather fast growing average size of farms that continue. The growth per individual farm is however very different. A lot of farms will maintain their size - these are in general the small-sized farms - over a rather long period and a part of the farms, mainly the larger-sized, will expand. They make use of the financial opportunities to invest.

A consequence of this may be a growing difference in the (absolute) levels of farm incomes. In some member states specific types of farms already show very large differences in income in one year (see for figures on distribution of incomes chapters 4 to 12). A clear consequence of the growth of individual farms using larger amounts of investments and increasing debts (and a lower solvability) is a higher level of financial risks.

The explanations in chapters 4 to 12 make clear that each type of farming has to deal with a number of specific risks, besides the general, normal 'economic' risks on prices of products, costs (input prices), and interest rates, as mentioned before. The specific, incidental risks are of a different nature, for instance: veterinary (outbreaks of animal diseases, stamping out of herds), phyto-sanitary, food safety (for instance dioxin in animal feed) and climatic (rain, frost, hail etc. destroying harvests or slowing down growth and resulting in very low yields). Such risks depend on the type of farming, and have strong regional impacts.

Samenvatting

Volatiliteit van het inkomen, de prijzen en de opbrengsten van boerenbedrijven in de Europese Unie

Introductie

Het doel van dit rapport is om de mate van veranderingen (of volatiliteit) in de inkomens in de landbouw te begrijpen. Voor de analyses is gebruik gemaakt van het FADN, het Europese boekhoudnet van landbouwbedrijven, dat gegevens bevat van ongeveer 60.000 bedrijven, die circa 4 mln. bedrijven in de EU (15) vertegenwoordigen. Benut zijn gegevens van de jaren 1990 tot en met 2003. In de analyses zijn belangrijke FADN-indicatoren het gezinsinkomen uit het landbouwbedrijf, de inzet van arbeid (gezinsarbeid, respectievelijk betaalde arbeid), de bedrijfsomvang in Europese grootte-eenheden (EGE), de opbrengsten (inclusief subsidies) en de kosten, met een onderscheid in algemene kosten, afschrijving, rente, pacht arbeid en directe kosten.

Instabiliteit van landbouwmarkten en fluctuaties in door de boeren ontvangen prijzen zijn de belangrijkste redenen voor de volatiliteit in de inkomens in de landbouw. De analyses per type landbouwbedrijven laten een aantal interessante aspecten op dit gebied zien.

Verschillen tussen typen landbouwbedrijven

De volatiliteit in inkomen (gezien de gemiddelde inkomens per jaar per lidstaat) is in sommige sectoren groter dan in andere. Melkveebedrijven hebben bijvoorbeeld in het algemeen een stabieler inkomen dan bijvoorbeeld varkenshouders. Een belangrijke reden hiervoor is dat de melkprijzen (zuivel) zijn gestabiliseerd door het Europese landbouwbeleid (GLB). Het GLB beheert de varkensvleesmarkt niet zodanig dat prijzen van dit product niet fluctueren. De hervorming van het GLB, met een ontmanteling van de instrumenten om prijzen te stabiliseren, kan leiden tot kleinere verschillen tussen sectoren.

Een andere reden voor verschillen in de mate van inkomensverandering tussen bedrijfstypen is de afhankelijkheid van bepaalde inputs: bijvoorbeeld mengvoeders voor gespecialiseerde varkens- en pluimveebedrijven, energie op glastuinbouwbedrijven. Prijsfluctuaties voor dergelijke inputs kunnen voor deze bedrijfstypen tot grotere inkomensveranderingen leiden dan voor andere bedrijfstypen, zoals de graasdierbedrijven en akkerbouwbedrijven.

Afgezien hiervan worden verschillen in de volatiliteit van landbouwinkomens veroorzaakt door de inkomensmarge: de opbrengsten van de producten verminderd met de betaalde kosten (en de afschrijvingen) als percentage van de opbrengsten. In het algemeen hebben de meer gespecialiseerde grotere bedrijven (vaak met betaald personeel) een kleinere inkomensmarge dan de 'traditionele gezinsbedrijven'. Bedrijven met veel arbeid kunnen bijvoorbeeld worden gevonden in de tuinbouw en intensieve veehouderij (varkens en pluimvee). Dergelijke grotere bedrijven met kleine marges hebben een grotere mate van verandering van inkomen dan de kleinere bedrijven.

Structurele veranderingen in de landbouw en op de markten

De volatiliteit van de inkomens in de landbouw zal toenemen in de loop van de jaren. Belangrijke redenen hiervoor zijn:

- *de ontmanteling van het GLB*
  De prijzen van bijvoorbeeld graan, melk en rundvlees zullen in de toekomst niet door het GLB worden beschermd en gestabiliseerd. De prijzen van deze producten kunnen meer gaan schommelen dan in het verleden. Prijsfluctuaties zullen resulteren in een (grotere) mate van verandering van inkomen van een grote groep bedrijven die zijn gespecialiseerd in akkerbouwgewassen, melkvee en andere graasdieren en gemengde bedrijven met deze producten. In de meeste lidstaten vormen deze bedrijfstypen (nog steeds) de meerderheid van het totale aantal landbouwbedrijven (hoofdstuk 4, tabel 4.2);
- *verhoging productiviteit en bedrijfsomvang*
  Gezien de aard van de landbouwmarkten en de invloed van veel andere factoren op de sector (zie hoofdstuk 3), verhogen landbouwers de productiviteit en de omvang van hun bedrijf. Grotere investeringsbedragen zijn hiervoor nodig. De inkomensmarge per eenheid product daalt voor een deel ook doordat de prijzen van landbouwproducten achterblijven bij de inflatie.

Toenemende verschillen en inkomensrisico's in een dynamische sector

De ontwikkelingen per type landbouwbedrijf die zijn beschreven in de hoofdstukken 4 tot en met 12 van dit rapport, laten een sterke verandering van de structuur van de landbouw zien in de periode 1990-2003. Veel bedrijven zijn verdwenen omdat boeren met hun activiteiten zijn gestopt en geen opvolgers hadden. Aan de andere kant zijn bedrijven uitgebreid. Zij gebruiken de productiefactoren en vooral het land van de gestopte bedrijven. Voor de meeste producten resulteerde de stijging van de productiviteit in een groei van de omvang van de productie, waardoor prijzen van landbouwproducten laag bleven.

Er zijn redenen om voor de komende jaren ten minste een vergelijkbare verandering in de landbouwstructuur te verwachten, zoals de GLB-hervorming, de uitbreiding van de EU, de uitkomsten van de WTO-onderhandelingen en de stijging van de productiviteit als gevolg van nieuwe technologieën. De algemene trends zijn: (1) elk jaar verlaat ongeveer 3% van de bedrijven de sector (op deze bedrijven hebben oudere bedrijfsleiders geen opvolger) en (2) er is een behoorlijk snelle groei van de gemiddelde omvang van de bedrijven die worden voortgezet. Veel bedrijven blijven langere tijd in omvang gelijk: dit zijn voornamelijk kleinere bedrijven, terwijl vooral de grotere bedrijven uitbreiden. Zij benutten de financiële mogelijkheden om te investeren.

Een gevolg hiervan is mogelijk een toenemend verschil in de (absolute) inkomensniveaus van landbouwbedrijven. In een aantal lidstaten zijn er al grote verschillen in inkomen tussen bedrijven binnen één type (zie figuren over de spreiding van inkomens in de hoofdstukken 4 tot en met 12). Een duidelijk gevolg van de groei van individuele bedrijven door omvangrijke investeringen en toenemende schuldenlasten (en een lagere solvabiliteit) is een toename van de financiële risico's.

De toelichtingen per bedrijfstype in de hoofdstukken 4 tot en met 12 verduidelijken dat elk bedrijfstype te maken heeft met specifieke risico's, afgezien van de normale 'economische' risico's wat betreft de opbrengstprijzen van producten, de prijzen van productiemiddelen (inputs) en de hoogte van rentetarieven. De per bedrijfstype specifieke en incidentele risico's zijn bijvoorbeeld: veterinair (uitbraken van besmettelijke dierziekten, ruiming van de veestapel), fytosanitair (besmettingen van planten), voedselveiligheid (bijvoorbeeld dioxine in veevoer) en klimatologisch (regen, vorst, hagel, droogte enzovoort, waardoor de oogst wordt vernietigd of de groei wordt vertraagd en de opbrengsten laag zijn). Dergelijke risico's zijn uiteenlopend per bedrijfstype en kunnen sterk van regionale aard zijn.

1 Introduction and problem statement

1.1 Introduction

Farmers' income is a theme of interest for policy makers, the press, the general public and of course farmers. Much attention is paid to the structural development and trends in the income levels; less attention has been paid to fluctuations in incomes. Farmers' incomes show strong fluctuations over time due to fluctuations in prices and yields. Fluctuations in yields are caused by natural conditions such as drought, heavy rain, frost and animal diseases and such yield fluctuations lead to even stronger price fluctuations (in non-regulated markets). Furthermore, farm incomes differ strongly within countries even among farms of the same farming type and farm size. External events directly affect farm incomes but also have strong indirect effects due to market reactions.

This report is part of the more extensive project on the stabilisation of incomes in farming.[1] The project proposal describes the background of this research:

> 'In a framework of changing agricultural risks, an enlarging European Union, changing views about eligible forms of income support, changing attitudes towards ad hoc disaster relief and continuing developments at private risk management markets, this project analyses the opportunities of different risk management tools for stabilizing farm incomes.'

An important first step is to develop an understanding of the stability or lack of stability in farm incomes. Farm incomes and especially the fluctuations in incomes are caused by fluctuations in yields and prices. This report gives a description of the fluctuations in farm incomes and the underlying factors.

[1] The FP6 Income Stabilisation project (2005-2008) focused on farm-level risk exposure analyses, a review of risk management experience and perceptions, and a synthesis towards policy options for viable (crisis) risk management in the European Union. Partners were from Germany (Rheinische Friedrich-Wilhelms-Universität Bonn), Hungary (Szent István University), the Netherlands (Wageningen University and the LEI, Poland (Warsaw University of Life Sciences) and Spain (Universidad Politecnica de Madrid). Main results of the project have been published by Meuwisse et al. (2008).

1.2 Objective of the report

The overall objective of this report is to develop an understanding of the fluctuations in farm incomes. More specifically, the objectives are:

- To analyse individual farm data with respect to price, production and farm income (FADN);
- To complete farm analyses with data on-farm households, where possible (OECD, ERS);
- To provide full insight into the price, production and income distributions including downside risk;
- To make a clear distinction between normal income fluctuations and income crises.

1.3 Structure of the report

Chapter 2 deals with the methodological questions and previous research. The data sources are described, and the advantages and disadvantages are identified. Chapter 3 presents a short description of factors that have an impact on the volatility of yields and incomes in agriculture. Chapter 4 analyses the major trends in farming in the period 1990-2003. In the subsequent chapters (5-12) more detailed analyses are presented for the 8 major types of farming. Chapter 13 analyses the impact of off-farm income on the volatility of farm income. Chapter 14 provides conclusions and a discussion.

2 Methodology

2.1 Introduction

This chapter gives an introduction into the methodology applied in this research. Section 2.2 gives an introduction into previous research on income volatility. Section 2.2 describes the main information source and the indicators used in this project. Section 2.3 and 2.4 give an introduction to the types of analyses presented in this report.

2.2 Previous research on farm income and volatility

Farm income is affected by numerous factors. Technical development results in increasing levels of yields due to factors such as new breeds and crops, the use of agro chemicals, better production methods and improved management skills. An increasing trend in yields is sometimes offset by drops in yields due to climatic risks or contagious (animal) diseases. Changes in yields can temporarily distort the balance of supply and demand on the market resulting in a change in prices. Temporary changes in prices can have a longer lasting effect due to adaptations in the market supply. These adaptations can affect farm incomes for a longer period of time.

Several papers describe the volatility of prices on agricultural commodity markets (FAO 2004). Others have studied volatility of yields in combination with prices (Polome et al., 2006). An important issue in these studies is the distribution of these volatilities. In much practical work, the hypothesis of normality is maintained (see Just and Weninger, 1999). Another important issue is the existence of an underlying trend in the development of prices and yields. Harmigny et al. (2005) show that in general yearly variations of yields or prices tend to follow either a stochastic process or a cycle, but not a linear trend.

Fluctuations in yields and prices result in strong dynamics in farm incomes. The relationship between yields, prices and farm income is not as straightforward as one might think. It is a complex relationship depending on the cost structure of the farm (direct costs, overhead costs etc.), other agricultural revenues and extra ordinary benefits or costs. The dynamics of farm incomes have been studied in several papers (Phimister et al., 2004; Hergrenes et al., 2001; Mishra and Goodwin, 1997).

Other papers have analysed differences in farm performance. Poppe and Van Meijl (2006) analyse the differences in farm profit, environmental performance and the underlying differences in farm strategy, innovation and management skills. Differences in farm income result in an income distribution with a wide dispersion in each country. Allanson and Hubbard (1999) develop rules to compare income distributions of different countries. Fluctuations in incomes and differences in performance between farms can to a large extent be considered as normal fluctuations in farm incomes.

Another line of research focuses on the impact of crises on the economic performance of farms. Mangen and Burrell (2003) for example analyse the different welfare aspects of a case of classical swine fever. A distinction is made between the different effects of the crises and those who suffer or benefit from these effects.

For the proper understanding of the behaviour of farmers and the development of farms it is important to realise that many of the farms combine agriculture with other economic activities (either non-agricultural forms of production on the holding, or employment or self-employment off the farm, or income from financial and real estate assets). Available data on these aspects is however limited. The Farm Structure Survey (FSS) indicates that some 30% of EU15 farmers had another gainful activity in 2000. Eurostat's Income of the Agricultural Household Sector (IAHS) statistics suggests that even among households for which farming was the main income source of the head, other income sources provided between a third and a half of average household income (Eurostat, 2002). There is a broad range of academic literature (e.g. Nakajima, 1986) and an accumulating body of empirical evidence that supports the importance of taking a broad view of resource flows when explaining farm-level behaviour (for example Harrison, 1975; Phimister, 1993; Allanson and Hubbard, 1999; Hegrenes et al., 2001; Findeis, 2002; OECD, 2002, 2004; Offutt, 2002). Characteristics that influence off-farm employment decisions are studied by Benjamin and Kihmi (2006).

Besides scientific research, income development is a topic described in many monitoring and policy oriented publications at national and European level (for example Berkhout and Van Bruchem, 2006; EU, 2007). The traditional micro-economic perspective applied in most of these publications will be briefly introduced in section 2.4.

2.3 Data sources: FADN

The European Farm Accountancy Data Network (FADN) was established in 1965 (DG-Agri, 2002). The primary aim of FADN is to gather data from farms for the determination of incomes and business analysis of agricultural holdings (farms). FADN is important to evaluate the income of farms and the impacts of the Common Agricultural Policy.

FADN consists of an annual survey carried out by the Member States of the European Union. Every year data are collected from a sample of the farms in the European Union. Farms are selected to take part in the survey on the basis of sampling plans established at the level of each region in the Union. The survey does not cover all the farms in the Union but only those which due to their size could be considered 'commercial'.

The yearly sample analysed in this research consists of approximately 60,000 holdings. They represent a population of about 4,000,000 farms in the 15 Member States, which cover approximately 90% of the total utilised agricultural area (UAA) and account for more than 90% of the total agricultural production of the Union. The information collected, for each sample farm, concerns approximately 1,000 variables. These variables include aspects such as:

Physical and structural data	such as location, crop areas, livestock numbers, labour force.
Economic and financial data	such as the value of production of the different crops, stocks, sales and purchases, production costs, assets, liabilities, production quotas and subsidies, including those connected with the application of CAP measures.

The advantage of FADN is that it is a harmonised data source with micro-economic data on the structure and the economic performance of farms. Harmonised means that the bookkeeping principles are the same in all countries. Micro-economic data provides the advantage that detailed information is available on individual holdings, which provide the opportunity to conduct analysis on a holding level and gives insight into the distribution and differences in incomes between holdings. It also makes it possible to analyse the effect of a policy measure on different objectives like income, environmental performance, and budget etcetera.

A disadvantage of FADN data is the time lag between the accounting year and the availability of the data for research purposes. In this research only data up to the year 2003 could be included in the analyses.

Another aspect of FADN is that it is a sample. This is not so much a disadvantage but one has to take this aspect into account when interpreting results. The values given in this report that are based on FADN are estimations. Some fluctuations can therefore be explained by the sampling methodology.

Another important aspect of FADN data is that they cover agricultural activities on farms. The FADN also collects information on a limited set of non-agricultural farming activities. This leads to an important distinction: income from farming versus total family income. A farmer can have income from non-agricultural activities, be it on or outside of the farm. This outside income and the income from farm activities together determine the disposable income of a farmer. This distinction is important to understand investment behaviour, survivability of farms etcetera. However, the FADN currently limits its data collection to agricultural and a limited set of on-farm, agriculture-related activities (such as forestry, contract services). This implies that certain effects of the policy changes in the recent past (e.g. a shift to non-agricultural activities) cannot be analysed with European data sets (Abitabele, 1999; Hill, 1996).

FADN Indicators

Family farm income	Family farm income is the reward for family-owned fixed factors of production (work, land and capital) and the reward for the entrepreneur's risks (loss/profit) in the accounting year.
Labour input	Labour input is expressed in working units. A distinction is made between unpaid family labour and hired labour. An important indicator is the family farm income per unpaid family labour unit.
Economic Size Unit	Economic size unit gives an indication of economic size of a holding expressed in European size units.
Number of farms	An estimation of the number of farms in the population.
Total Assets	Total assets is the value of land, building and machinery.
Revenues	Revenues include the revenues from agricultural products plus the subsidies on livestock and crops and other subsidies.

Incorporated into the founding legislation of FADN is a stipulation that all data relating to individual farms received by the Commission are to be treated with utmost confidentiality. This means that information relating to individual

farms cannot be discerned. In this report no statistics will be presented if the data are based on a group fewer than 15 observations.

2.4 Farm typology as segmentation variables

The major segmentation variable used in this research is *type of farming*. In this research the types of farming as used in FADN publications (based on Eurostat's farm typology) is applied. These types are listed in table 2.1. Within each type of farming relevant products have been selected of which the volatility in prices and productivity will be further analysed. It should be noted that the classification of farms according to type is based on the (relative) mix of their output. Therefore dairy farms can also be responsible for a part of beef or cereal production.

Table 2.1 Types of farming

Number	Type	Products
1	Field crops	Wheat Potatoes Sugar beets Barley Sunflower Rape seed
2	Horticulture	
3	Wine	
4	Other permanent crops	Apples Pears Citrus fruits Olives
5	Dairy	Milk
6	Grazing livestock	
7	Granivores	Pigs Eggs
8	Mixed (crops and livestock)	Combination of other products

For types of farming a *regional division* is applied. The most important regions are identified based on the number of farms and the economic size of the farms. For these regions aggregated information of farms belonging to that type are presented.

2.5 Data analysis

This report makes a distinction between normal income fluctuations and income crises in agriculture. Normal income fluctuations are similar to the traditional micro-economic perspective. Based on individual farm observations averages of groups are calculated and presented. This report will however show that this traditional approach of comparing group averages over years hides or underestimates fluctuations at farm level because of large differences between farms. Therefore this report also takes a closer look at the developments over years at individual farm level. The heterogeneity of farms and the volatility of incomes at individual farm level are analysed. Heterogeneity is important because there are large differences in the results of individual farms even within the same year or the same type of farming. Heterogeneity is illustrated by showing the range of incomes during a specific year in a specific country. Normal income fluctuations of individual farmers over years are illustrated by a number of measures. The first measure is the yearly trend. The trend describes the average yearly change. To account for strong fluctuations between years, the average of the first 3 years (1990-1992) is calculated and the average of the last three years (2001-2003) is calculated. The trend is calculated based on these two averages. The next measure is the volatility of group results. This indicator presents the mean yearly deviation from the trend. The previous measures are based on group statistics. Furthermore some indicators are based on the development of individual farms. An important indicator is the coefficient of variation (cv) of farm income on an individual farm. This cv of an individual farm is calculated as the standard deviation of all observations of an individual farm divided by the average of those observations.

Income crisis is analysed according to two approaches; one is a case-based approach in which the impact of specific crisis in the past on the income of farmers is analysed. The second approach estimates the down side risk of farms by simulating the impact of a crisis on the income situation of farms. The shortfall risk is defined as the chance that a farmer will have a negative farm income after the occurrence of an external event.

3 Driving forces of volatility of incomes in agriculture

3.1 Introduction

Incomes of farmers fluctuate for a number of reasons. Farmers have to deal with variations in (a) the prices of their products, (b) the yields on their farm and (c) the prices of the inputs used on the farm. Each of these main reasons for a lack of stability in farm incomes has specific backgrounds. These factors will be analysed in this chapter. We will conclude with some observations on the impact of the changes of the CAP on these factors.

3.2 Prices

Inelastic markets

Farmers in general produce on a small scale on a market with many suppliers. In effect, the market is becoming increasingly international. Individual farmers have no influence on the market. On the more open and integrated market of the European Union even the larger co-operatives of farmers are not able to exercise market power to guarantee acceptable prices for their members, the farmers.

Besides this specific situation on the supply side of the market of agricultural products, the demand of consumers is rather inflexible (table 3.1). Most products show a very low elasticity. This means that demand hardly increases in case of lower prices. This is especially the case for products which are consumed regularly. Only for meat and fish, which seem to be luxury food products, demand grows when prices are lower.

The supply of farm products reacts to higher prices in a somewhat restricted way (table 3.1, right column). This reaction however is in general stronger than the reaction in demand shown in the left column. This means that the increase in supply as a reaction to higher prices often leads to an oversupply on the market. Consumers are not willing to buy a larger volume when prices decrease. This development results in lower prices.

Table 3.1	(In)elasticity of prices of farm products (% change of volume at 1% change of price)		
Demand		**Supply**	
Sugar	-0.01	Potatoes	0.11
Potatoes	-0.02	Beef	0.15
Vegetables and fruits	-0.03	Pig meat	0.25
Dairy products	-0.15	Cereals	0.34
Meat and fish	-1.01	Eggs	0.65
		Poultry meat	1.36

Source: Jongeneel (2000).

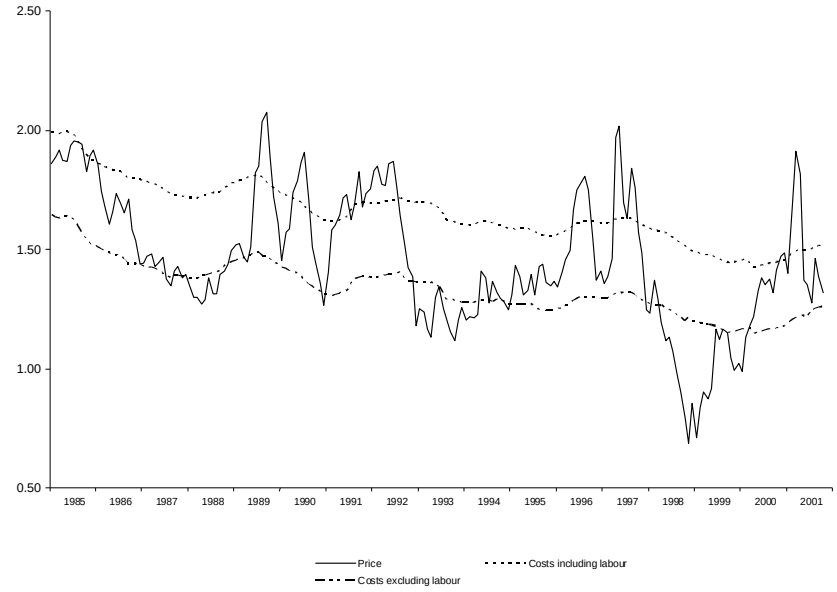
Price cycles

Prices of some farm products follow a cyclical pattern (the pig price cycle, appendix, figure 3.1). In this cyclical pattern the volume of production and thus the supply on the market reacts to the price level. A period of higher prices stimulates investments in the sector, including enlargements in the animal production as well as an increase of the area planted with the crop concerned. An increasing supply is the result of these investments. This growing supply, however, is not absorbed by the market at a stable level of prices, which results in prices going down. On this lower level of prices a decrease of production will follow; some producers will discontinue their farm. The pig price cycle is not only in force on the pig market. In principle it is in force for all products for which the supply can react to changes in prices. Products with a pig price cycle are for instance eggs, tomatoes and ware potatoes (appendix figure 3.2). The price cycle in general includes a period of three to five years. In this period incidental factors may disturb the normal course of the cycle: for instance animal diseases such as swine fever in the Netherlands in 1997/98 and a period of drought reducing the potato harvest in 2003.

Farm policy

The characteristics of the markets of farm products described in the previous sections were one of the main reasons for the start of the CAP. A major pillar of the CAP is the market and price policy to support prices at an agreed minimum level (intervention prices). Due to this system prices of products such as cereals, sugar, milk and beef were quite stable.

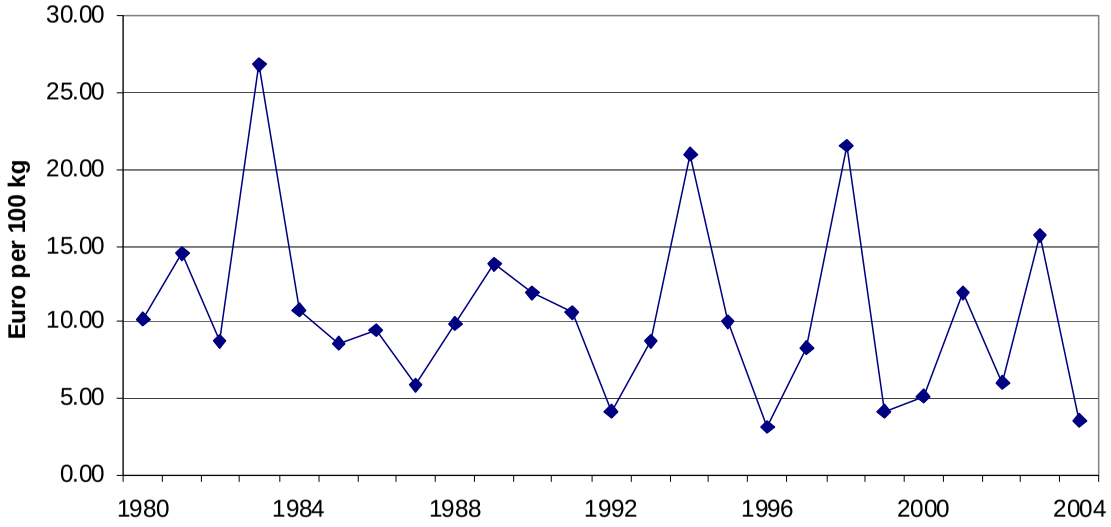
Figure 3.1 **Price of pig meat in the Netherlands (in euro per kg, slaughtered weight, including VAT)**



During the seventies as well as the first part of the eighties, the CAP-system included an annual review of prices. This resulted in price increases in line with the development of the costs of production for the farmers. This annual review, with in some years long debates on the proposals of the Commission among the EU agricultural ministers, was later abolished. CAP Reforms included a decrease of prices of several products.

Farm prices, in nominal terms, in general show a modest increase over a long period (table 3.2). In real terms farm prices went down. Compared to the huge increase of salaries and land prices from 1960 onwards, the farm product prices strongly lag behind.

Figure 3.2 **Average revenue of ware potatoes in the Netherlands (in euro per 100 kg, including VAT)**



3.3 Yields and productivity

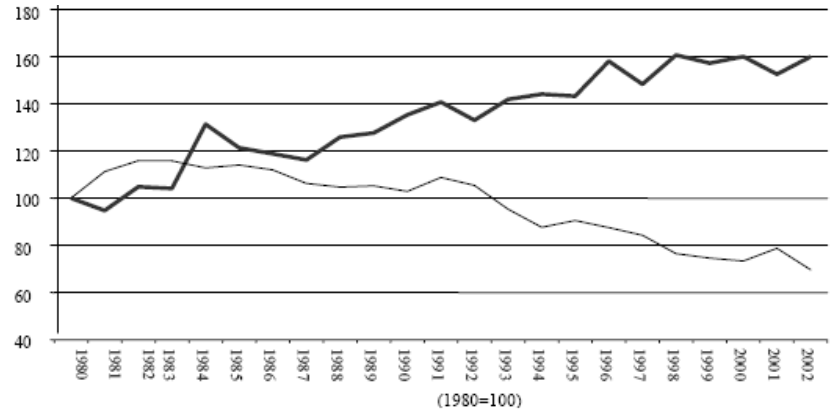
A major driving factor for the modest development of farm prices shown in table 3.2 is the increase of productivity. Productivity gains include a higher level of yields per hectare of land (figure 3.3), per animal as well as per labour unit. Productivity gains are amongst others the result of research, extension, schooling, new breeds of crops and animals, improvements in conditions of production (e.g. water management, animal health), the use of fertilisers and other agrochemicals, investments in machinery and buildings.

Table 3.2 **Development of prices in The Netherlands (in euro per 100 kg)**

	1960	1980	2000	Nominal development 1960-2000 (%)	Real development 1960-2000 (%)
Milk	10	26	29	290	54
Pig meat	97	152	123	127	23
Eggs	88	98	74	84	16
Potatoes	4	9	6	141	26
Vegetables (index)	100	237	226	226	42
Fertilizer	10	19	15	150	28
Compound feed	14	26	17	121	22
Salaries (euro per year)	1,750	11,440	19,240	1,099	203
Land (euro per hectare)	1,348	16,750	35,850	2,659	490

Source: LEI, CBS.

Figure 3.3 **Index of development of yields (thick line) per hectare and prices of wheat (thin line) in the EU, 1980-2002, 1980=100**



Incidental factors, however, may cause a severe discontinuation in the trend of increasing production. The production volume of crops may decrease for instance by drought, frost, hail and heavy rains. For some farmers this is a catastrophe; they may loose their harvest. At the same time however for other farmers it results in higher prices for the products concerned (some of these cases are described in more detail in the next chapters).

Animal diseases may have comparable consequences for farmers. Even if the value of the animals, which are destroyed - so-called 'stamping out' - to restore the veterinary situation in a region, is compensated by the EU and or by national funds, farmers will have a lack of income due to a loss of returns during that period. On the other hand, producers outside the directly affected regions might benefit from higher prices as a consequence of a lower supply. The first consequence of this is a significant difference in incomes between farmers in the same sector during the same period. The second consequence is a larger fluctuation of prices and incomes than under normal market conditions.

Specialisation

To achieve a reasonable income, farmers have to obtain a good level of productivity, not only per hectare or per animal. The volume of production per labour unit is a significant factor. Higher specialisation results in lower costs of investments (machinery, buildings, etc.) per unit of product.

The process of specialisation in agriculture has two effects on the volatility of farm incomes (1) the individual farmer will have a larger volatility in income

depending on the development of prices and yields of the product(s) on the farm and (2) the farm sector in general will have larger differences in incomes between producers depending on the selection of products.

3.4 Costs

Besides the impact of prices, yields and productivity on the income of farmers, prices of inputs may have a significant influence. In particular, the income of some types of farms is heavily affected by changes in prices of inputs. Table 3.3 shows this for the Netherlands. In the granivore sector, with farms specialised in pigs or poultry, the impact of fluctuations in the prices of the main input (compound feed) is very strong (up to 75%). On the other hand, on dairy farms as well as on arable farms the impact of the prices of the most important inputs is rather modest. Table 3.3 shows that the impact of compound feed prices on the income of dairy farmers in the Netherlands is rather limited, especially in comparison to the impact of the price of milk (273/1,515= some 18%).

Table 3.3 **Impact on income of 1% change in price per farm type, in euro (2003)**

Farm type	Income	Product	Impact on income	Input	Impact on income
Dairy	39.5	Milk	1,515	Compound feed	-273
Arable	51.5	Plant potatoes	451	Plant protection	-183
		Ware potatoes	332	Fertilizers	-85
		Sugar beet	244		
		Wheat	154		
Pig breeding	-33.5	Piglet	2,012	Compound feed	-1,574
Pig fattening	-10.5	Pigs for slaughtering	2,476	Compound feed	-1,236
Laying hens	176	Eggs	6,077	Compound feed	-2,513
Broiler	-2	Broilers	5,761	Compound feed	-4.31

Source: LEI (De Bont en Van der Knijff, 2003).

Energy prices (mainly natural gas) have a large impact on the income of horticultural farms producing vegetables, flowers and plants in greenhouses. For the year 2005 energy costs are estimated to be 25% of the returns of vegetable growers, 20% of the returns of flower growers and 12% of the returns of

plant growers in the Netherlands (De Bont en Van der Knijff, 2005). It is obvious that the farm sector experiences a pressure on income in periods with increasing prices of energy (mainly oil) which have an impact on the prices of other inputs, such as fertilizers and plant protection.

Changes in interest rates can have a large impact on the level of incomes, especially on those farms with a low rate of solvability. In some countries, at least on some types of farming, the debt burden is relatively high (for instance above 50% of total assets). An increase of the interest rate with 1 percentage-point may have a negative impact of thousands of euros per year. The risk of higher interest payments is growing because of the pressure on farmers to invest to achieve benefits of scale of productivity and gains in productivity. Farming is becoming a more capital-intensive sector in which family loans at a lower interest rate become less important. The risk of higher and fluctuating rates seems to have decreased by the rules of discipline in the frame of the European Monetary Union.

The introduction of the euro has moreover decreased the risks for farmers in most member countries (in the Euro zone) of fluctuating prices of products as a result of devaluation or revaluations of currencies. During the seventies and the eighties farmers had to deal with those risks. The European Union tried to avoid that with the introduction of monetary compensation amounts (mca) in the CAP. The mca system, however, was complex and expensive.

3.5 Observations on incomes and fluctuations

Given the analyses on prices, yields and productivity and costs in agriculture presented in the sections 3.2-3.4, some developments become clear.

A general point in agriculture is that the income margin between returns and (paid) costs - intermediate consumption of inputs, depreciation, paid labour, interest and rents - is rather small. For instance this margin is between 10 to 15% of the returns of the whole agriculture sector in the Netherlands (including horticulture, excluding trade and processing industries). Around this average margin of 10 to 15%, the margin has a variation between types of farms. This small margin results in strong fluctuations in incomes, even with a relative small change in prices. For instance with a margin of 10% incomes will increase or decrease with 50% if product prices will go up or go down with only 5%.

The tendency is that the income margin is decreasing over the years. One of the reasons for this is the CAP Reform. Based on the CAP Reform the prices of some main products (cereals, sugar, milk and beef) are not adjusted to com-

pensate farmers for increasing costs (prices of inputs, labour costs, inflation). In contrast with increases in the past, prices have been cut down during the last decades. Farmers are compensated for a part of the decrease of prices. These (decoupled) compensations are not adjusted for inflation. The CAP Reform may result in a price level comparable with that on the world markets. At least one of the results of the negotiations in the WTO (GATT Uruguay round) was that farm prices on the EU market are not protected by variable levies, but (only) by constant tariffs on imports. This means that fluctuations in prices on the world markets have a direct influence on the prices in the EU.

Another reason for shrinking margins is the increase of productivity and the continuous increase in the scale of production. Farmers have to invest in realising a higher level of productivity as well as a larger volume of production. Given the inelasticity of demand, a higher supply of farm products results in disproportionally lower prices as well as a smaller income margin. At least for some products, as is shown in this chapter, the consequence is a cyclical evolution of production and prices. Fluctuating prices of products combined with a smaller margin and a higher volume of production per farm lead to an increased volatility in incomes.

3.6 The effect of the CAP Reform on farmers' risks

Farmers face increased risks as a result of uncertainty on future agricultural policy. Once political discussion on changes in the policy starts, the business' future is less certain, investments are harder to take: there is an exposure to a policy risk.

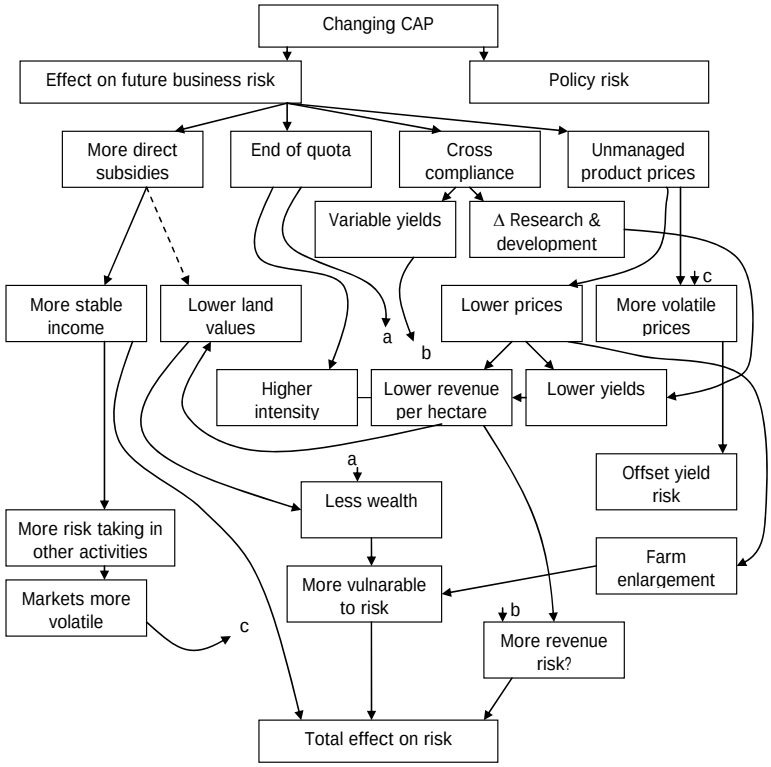
This risk can be broken down in two aspects: the chance that policy changes in a certain direction - 'Will we get a flat rate or direct payments based on historical entitlements?' - and the change in risk profile of the (current or future) farm system under that direction - 'Is my current farm exposed to more or less risk under a flat-rate system?'

For e.g. arable and dairy farms the latest CAP Reform can be analysed along the four aspects of that policy change:

- More direct subsidies;
- Unmanaged/liberalised markets;
- End of quota;
- Cross compliance.

Figure 3.3 provides a system-dynamics drawing that shows the links between effects.

Figure 3.4 **System dynamics of impact of CAP on risk of farms**



More direct subsidies means that the income from farming becomes more stable than under a system where subsidies (or protection) received on production volume, for instance when production changes from year to year due to weather circumstances.

Since farmers already have a stable source of income in the direct payment, they could opt for more risk in their other activities. Compared to the pre-reform situation they would then have the same risk level in their portfolio. It could even be that they opt for more risky crops than in the pre-reform situation. This is the so-called insurance effect.

On the other hand the lower income and the lower wealth - we explain below why that is the case - could cause farmers to want to reduce their risk exposure. This is the so-called wealth effect: economic theory assumes that with lower levels of wealth, people have less willingness to accept risk - a practical example is that only very rich people underwrite risks as a 'name' at Lloyds in London as they are wealthy enough to survive a catastrophic event. And of course taking that risk is rewarded with a nice profit.

The CAP Reform implies unmanaged markets and (hence) lower product prices. These lower product prices mean a lower income. So at first sight the biggest effect is a lower, but more stable income. But unmanaged markets also increase the volatility of product prices. Prices for e.g. starch potatoes or sugar beet will increasingly look like volatile prices of ware potatoes or pigs. So even without changing the production plan, the market revenues will become more risky.

Markets will become more volatile over short periods, but also more cyclical. More often the cob-web theorem resulting in hog-cycles will be present. Due to the insurance and wealth effect (see above) farmers will move in or out the production of certain products. After a year with high prices acreages increase or decrease less than the trend. Fewer farmers stop production. As a result prices decrease, more (older) farmers retire, acreages decrease, prices drop etcetera.

Lower product prices mean a lower value of the marginal revenue. At the margin farmers try to balance marginal revenue and marginal costs, so the lower prices will lead to lower inputs: the last kg of fertiliser or the last spraying of wheat against a disease is not profitable anymore. This could lead to lower yields, and higher volatility in yields. It could also lead to lower productivity trends, as e.g. breeders go for more robust varieties and less high yielding ones that demand expensive chemicals.

There is a second reason why yields might be lower and more volatile. This is due to cross compliance. Cross compliance measures could lead to lower productivity levels (yields are lower if e.g. the Nitrate directive is respected) and more yield risk (less spraying in the neighbourhood of water to respect the Water Directive).

A large part of the increased yield risk will be offset or even overcompensated by the price mechanism. In technical terms: the co-variance between yield and price risk means that the downward risk of low yields will be translated into high prices. The market for ware potatoes gives a good example: in a year like 2006 with low yields (due to extreme weather), prices can rocket sky high.

The total effect is therefore complex: yield risks will increase and be more skewed to extremer low yields. This will be compensated by more volatile prices,

skewed - from time to time - to very high prices. Revenues per hectare will be lower in unmanaged markets, but on average this will probably mean that revenues per hectare will be more volatile and skewed to low yields and high prices. On average the combined risk effects makes the average revenue per hectare not decline as much as one might expect from looking at the liberalisation of prices only.

Lower revenues per hectare implies lower land values, and therefore a loss in wealth due to the CAP Reform. The end of quotas (or lowering the value of quotas due to lower guaranteed product prices) also makes farmers less wealthy, and - with unchanged levels of loans - more in debt. An exception could be the cases where the abolishment of quotas could lead to higher intensity of farming, e.g. higher stocking rates in dairy farming. Cross compliance and environmental legislation however make this rare.

In conclusion, after the CAP Reform the future farm business will see lower incomes, lower revenues from the market, less wealth and therefore will be more indebted. Revenues from farming will be more volatile, with downward skewed yield risks, offset by upward skewed price risk. The volatility will, due to lower income and wealth, translate much faster into a viability problem for individual farms. Hence risk management by farmers becomes more important. The total effect on income and risk is a matter of empirical estimation. It will differ between different farm types. Farmers who own land will see a bigger decrease in wealth than farmers who rent. Farmers with certain types of fixed-volume, fixed-price contracts could experience a big increase in risk if they do not change their business practice. One of the few products untouched by the CAP over the last 40 years is seed and ware potatoes. Producers of starch potatoes or milk will in future experience similar market conditions.

4 Volatility of farm incomes

4.1 Structural changes in agriculture

During the last decades the agricultural sector has changed drastically. The number of commercial farms has decreased at a continuous rate in almost all member states, while at the same time the average size of the farms has increased strongly (see table 4.1). The yearly decrease in the number of commercial farms varies between close to zero in Luxemburg and Spain to 7% in Portugal.[1] The average farm size in countries like Greece and Ireland increased with 20% during this period. In countries like Germany, Denmark, Spain and Portugal the average almost doubled. The increase in Germany can be partly explained by the reunification. Denmark shows a strong decrease in the number of farms and, at the same time, a strong increase in the average size of farms. Both are aspects of the restructuring of the sector. Also the assets per labour unit have increased strongly during this period. Besides an increase in the value of land, this points at investments in machinery and buildings. These trends point at an increased concentration and intensification in agriculture. To maintain labour productivity and income, farming has become a capital-intensive business.

Given the decrease in the number of agricultural holdings and the almost stable labour input per farm, the conclusion can be drawn that agriculture has become a less important employer (regionally). The number of households depending on an income from agriculture is decreasing. The stable labour input per farm can be observed for both the unpaid family labour as well as the hired labour input.

The data illustrate that the farm sector continues to restructure. Given the technological change - as illustrated by larger and more efficient machinery and buildings - many farms are too small to provide an income to the next generation. On small farms investments are often lacking and the current owners do not invest, but consume their capital. Their potential successors are forced to take another job.

The structure of agriculture differs between countries. An obvious difference are the types of farming that can be found in a country. Table 4.2 gives an

[1] The yearly trend is the average yearly increase or decrease between the beginning of nineties and the beginning of the new millennium. The beginning is the average of 1990 to 1992 and the end is the average of 2001 to 2003.

Table 4.1	Number of commercial farms (x 1,000) and average size of farms (in ESU)									
	Number of farms					Farm size (ESU)				
	1990	1995	2000	2003	% trend	1990	1995	2000	2003	% trend
Germany	336	295	253	214	-3.2	33.6	48	68.9	90.8	8.0
France	512	411	394	368	-2.6	38.7	49.3	69.5	75.6	5.6
Italy	1206	844	926	685	-0.5	12.9	16.4	17.1	30.1	5.6
Belgium	50	45	39	36	-2.5	52.6	65.2	79.7	88.5	4.3
Luxemburg	2	2	2	2	0.0	43.4	46.6	55.1	61.3	2.6
Netherlands	92	85	76	66	-1.9	81.5	107.4	121.6	137.7	4.8
Denmark	77	53	45	39	-5.2	44.9	67	84.2	96.5	6.0
Ireland	135	128	122	113	-1.2	18.8	19.1	22.8	22.6	1.7
UK	137	132	122	97	-1.7	65.2	72.9	86.5	107.7	3.7
Greece	560	492	516	489	-1.1	7.9	8.6	9.1	9.4	1.5
Spain	652	475	704	613	0.4	10	13.2	17.3	23.5	6.1
Portugal	413	325	292	160	-7.3	5.7	6.6	7.8	11	6.1
Austria		90	80	77	-1.7		21.9	23	27.2	1.3
Finland		47	46	43	-1.8		24.4	38.1	36.1	2.2
Sweden		41	38	31	-1.5		37.3	50.1	55.7	4.0

Source: FADN-CCE-DG Agri; adaptation by LEI.

indication of the importance of the types of farming in the different member states. In this table, '24' under in the heading 'Field crops' for Germany indicates that 24% of the farms in Germany belong to this farm type. Field crops is clearly an important sector in most countries. Horticulture has a significant share in Belgium and the Netherlands. Wine is an important sector in France. Other permanent crops - mainly olives and fruits - are important in Italy, Greece, Spain and Portugal. These same countries are the exception to the importance of dairy in Europe. Grazing livestock is especially important in Ireland and UK. Granivores - pigs and poultry - have the highest share in the Netherlands. Mixed farming is still of significant importance in Germany, Belgium, Denmark, with shares close to 20%. These figures tell something about the relative importance of the sectors in the individual countries. Given the large number of farms in for example Italy and Spain these countries can still be of major importance to a sector even if the percentage of farms specialised in that type in that country is low compared to other sectors. However, the structure of farming in a country is also very important in understanding the developments at country level. The analyses per type of farming are presented in chapter 5 to 12.

Table 4.2 **Distribution of type of farming per country (average for 2001-2003)**

	Field crops	Horti-culture	Wine	Other perm. crops	Milk	Grazing livestock	Grani-vores	Mixed
Germany	24	4	4	3	34	6	3	23
France	29	2	14	3	18	19	2	12
Italy	39	4	10	32	6	5	1	4
Belgium	15	10	.	5	22	21	9	19
Luxemburg	5	.	12	.	47	18	1	16
Netherlands	15	16	.	6	34	13	10	7
Denmark	50	2	.	1	18	1	8	20
Ireland	4	0	.	.	22	72	0	3
UK	29	3	.	1	20	35	3	8
Greece	38	2	2	44	0	8	0	5
Spain	26	6	4	41	5	10	3	5
Portugal	32	5	15	20	7	11	1	10
Austria	18	0	6	3	35	19	6	13
Finland	34	6	.	1	41	6	4	8
Sweden	42	.	.	.	32	9	2	15

Source: FADN-CCE-DG Agri; adaptation by LEI.

4.2 Development and fluctuations in family farm income per country

Table 4.3 presents the development in the nominal farm incomes. The values give an estimation of the average income in a specific country in a specific year. The last column gives the average yearly development during the decade (average for 2001-2003 compared to average for 1990-1992). The last column shows that the nominal incomes have strongly increased in Italy, Spain and Portugal. Ireland, Denmark, France and Germany also show a substantial yearly growth.

Average farm income gives an indication of the results of the average farm. There is however a huge difference in the financial performance of farms within one country and within one type of farming. These differences will be described in the following chapters.

Figure 4.2 combines three aspects in one figure. The yearly fluctuations in farm income are related to the size of the farm and the farm income. Farm income is calculated as a three year group average (2001-2003), the size of the farm is the average size of the farm in 2003. The fluctuation in farm income is calculated as the average deviation from the trend. The figure clearly shows that there is a positive relation between the size of the farm and farm income. The main exception is Denmark with rather large farms but very low incomes. The yearly fluctuation of incomes shows a more complicated picture. Countries like the Netherlands and the UK with the largest farms also have the highest group income changes. Countries like Germany and Belgium with slightly smaller farms have much smaller yearly fluctuations. Among these two countries Belgian farms are able to achieve substantial higher incomes compared to their German colleagues.

Development and fluctuations of farm incomes in types of farming

Table 4.4 shows the development in the farm incomes in the European Union for the different types (and subtypes) of farming. Types of farms that show the strongest improvements are the specialised olive farms and specialised cereal farms. Both show an annual increase of 6%. Granivores and especially pig farms show the lowest increase. The fluctuations of incomes are the highest among the intensive livestock farms (see figure 4.3). In particular 1998 and 1999 were very bad years for the pig farms. This influence can also be observed in the fluctuations of the incomes of mixed farms.

The highest incomes are achieved in horticulture and in some years in the granivore sector. The lowest incomes can be observed in the other permanent

Figure 4.1 **Fluctuations in average farm income per country per year (x €1,000)**

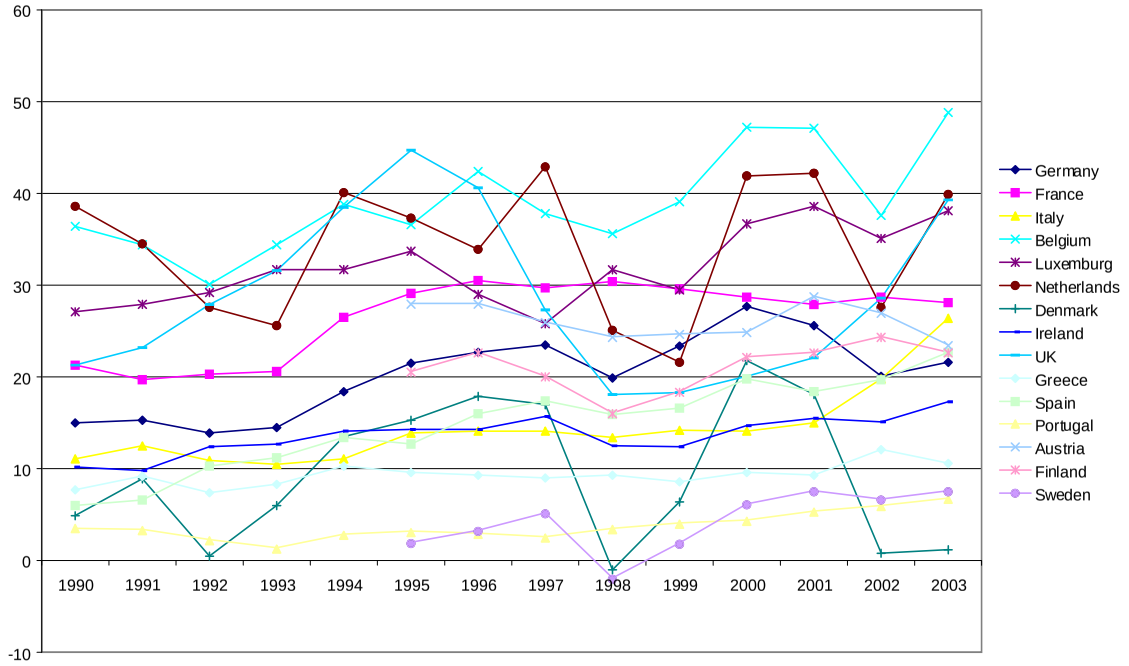
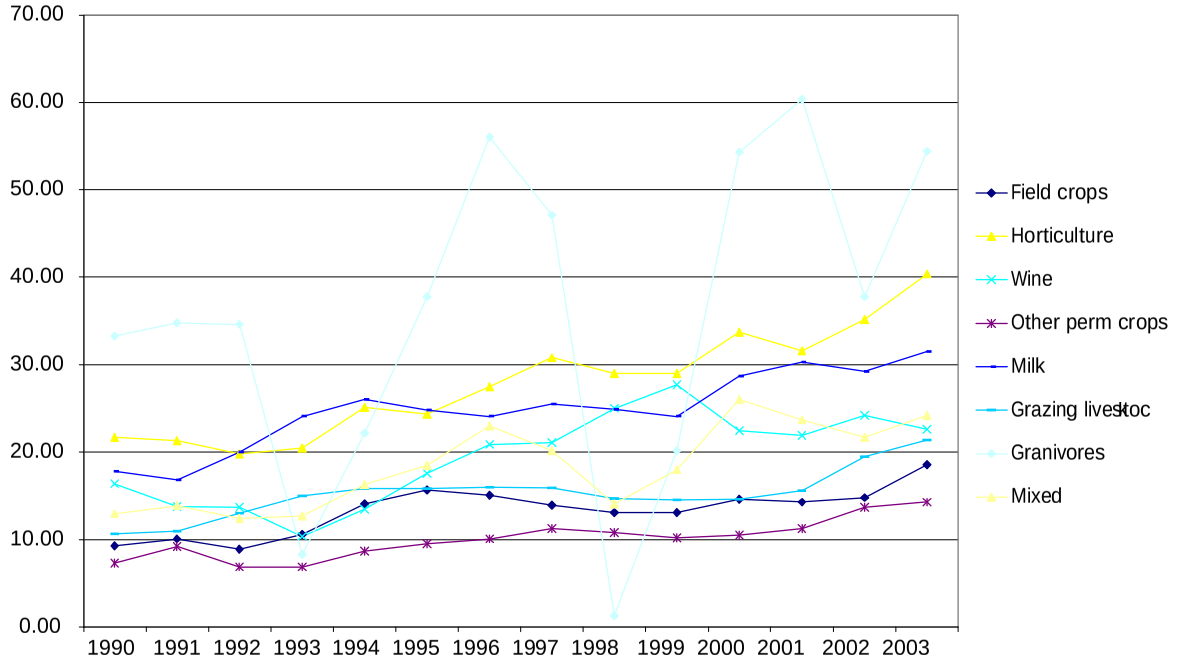


Table 4.4	Average farm incomes (x €1,000) in EU farming types														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Field crops	9.3	10.1	8.9	10.6	14.1	15.7	15.1	13.9	13.1	13.1	14.6	14.3	14.8	18.6	4.9
- cereals	6.6	7.7	8.1	10.2	15.8	18.6	17.4	14.7	12.2	13.2	13.5	11.8	12.9	17.1	6.4
Horticulture	21.7	21.3	19.8	20.5	25.1	24.4	27.5	30.8	29.0	29.0	33.7	31.6	35.2	40.4	5.5
Wine	16.4	13.8	13.7	10.4	13.5	17.6	20.9	21.1	25.0	27.7	22.5	21.9	24.2	22.6	4.6
Other perm crops	7.3	9.2	6.9	6.9	8.7	9.5	10.1	11.3	10.8	10.2	10.5	11.3	13.7	14.3	5.3
- fruits	8.4	10.2	7.5	6.4	8.1	8.3	10.1	9.9	10.8	9.3	10.9	12.2	13.9	16.5	5.0
- olives	5.2	7.9	5.5	6.8	8.8	9.5	8.9	11.7	9.6	10.2	10.1	9.9	13.1	10.4	6.0
Milk	17.8	16.8	20.0	24.1	26.0	24.8	24.1	25.5	24.9	24.1	28.7	30.3	29.2	31.5	5.2
Grazing livestock	10.7	11.0	13.0	15.0	15.8	15.8	16.0	15.9	14.7	14.5	14.6	15.6	19.5	21.4	5.0
Granivores	33.3	34.8	34.6	8.3	22.2	37.8	56.0	47.1	1.3	20.2	54.3	60.4	37.8	54.4	4.0
- pigs	35.0	45.1	38.0	4.0	25.5	41.2	59.2	50.8	-8.5	18.6	57.8	60.5	32.4	51.8	2.0
Mixed	13.0	13.9	12.4	12.7	16.3	18.5	23.0	20.2	14.1	18.0	26.0	23.7	21.7	24.2	5.9

Source: FADN-CCE-DG Agri; adaptation by LEI.

Figure 4.3 **Fluctuations in average farm income per type of farming (x €1,000)**



crops sector. Despite the strong growth of the average income of cereal farms the level of incomes is still quite low compared to some other types of farming.

4.3 Within-farm volatility in different regions of Europe

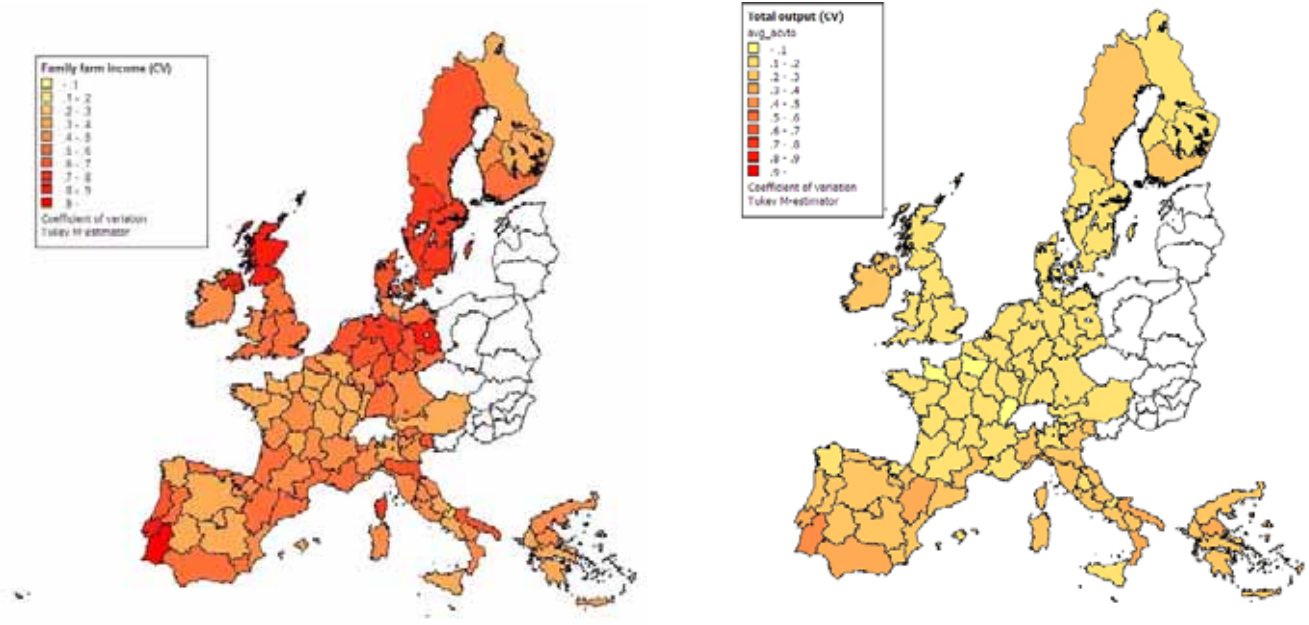
The previous section presented analyses based on group averages. This section will focus on the volatility of farm incomes at individual farms. Table 4.5 presents an EU-wide analysis of the differences in volatility for the different types of farming. Volatility is measured as the coefficient of variation of farm income. The coefficient of variation is clearly higher in the intensive livestock sector. In the dairy and grazing livestock sector the incomes are the most stable. Aggregating data over the whole of Europe of course hides large differences between regions. Therefore figure 4.4 presents the coefficient of variation for the different regions in Europe. The values reflect a combination of factors, such as: the climatic conditions, occurrence of diseases, the type of farming prevalent in the region, crops and animal products produced etc. The highest volatility of farm incomes can be found in the north-western part of Europe. This contrasts with some previous research and expectations with respect to the climatic circumstances in different parts of Europe. Therefore the right half of figure 4.4 - see appendix - presents the volatility of total output. This picture shows that the output volatility, which is conceptually more correlated with the production circumstances, is higher in the southern European countries and to a lesser extent in the Nordic countries. Comparison of both halves of the figure reveals that the volatilities of farm income are much higher than those of production value. Farm income is much more volatile because it is a residual indicator. More specific analyses have shown that although the production volatility in Spain is higher than in Germany or the Netherlands, the volatility in net value added or family farm income is higher in the latter (see table 4.7). This is mainly caused by the differences in the (financial) structure of farms.

Table 4.5	Volatility at farm level EU-15 (1996-2004)
Type of farming	**Coefficient of variation of Family Farm Income Tukey M-estimator a)**
Field crops	0.31
Horticulture	0.37
Wine	0.33
Other permanent crops	0.33
Milk	0.28
Grazing livestock	0.31
Intensive livestock	0.53
Mixed	0.29

a) Tukey M-estimator is used to estimate the central tendency. The M-estimators have the advantage that they are less sensitive to outliers or extreme values in the data set. Extreme values have a lower impact on the results by weighting the observations based on their deviation from the mean.
Source: EU-FADN - DG AGRI G-3.

Table 4.6 gives an overview of differences in farm volatility in different countries in the EU and within different types of farming. The values display the index compared to the overall central tendency of the coefficient of variation (0.3144). In most countries the intensive livestock sector has the highest within farm volatility. Exceptions are Austria, Portugal and Finland where the other permanent crops sector (fruit) shows the highest volatility. The numbers for Italy are quite different, the intensive livestock sector but also all other sectors show a low volatility. The volatility of incomes of mixed farms is rather high in some countries. Although diversification can be used as a risk management strategy, the overall volatility strongly depends on the agricultural activities on the mixed farms. In Germany, Denmark and the Netherlands, it is for example quite common that mixed farms produce pigs. The volatility of the revenues from pig production has a strong impact on the total farm income volatility. Whether diversified farms have a lower volatility in comparison to specialised farms strongly depends on the types of activities on those farms.

Figure 4.4 **Within-farm volatility of family farm income and total output per region in EU-15**



Source: EU-FADN - DG AGRI G-3.

Table 4.6	Index of within farm volatility in different countries and types of farming 1996-2004 (index = 100 equals 0.3144)							
	Field crops	Horti-culture	Wine	Other permanent crops	Dairy	Grazing livestock	Intensive livestock	Mixed
BEL	87	101		145	61	81	193	94
DAN	109	158		177	102		264	118
DEU	134	130	107	144	101	121	191	158
ELL	102	107	75	109	95	68	204	59
ESP	97	145	108	122	99	90	153	76
FRA	113	126	145	182	85	99	179	96
IRE	82				73	121	200	84
ITA	78	82	78	85	75	75	85	61
LUX	181		121		96	98	340	180
NED	217	174		146	113	291	475	216
OST	89	94	117	154	82	79	127	98
POR	116	111	171	184	112	112	169	126
SUO	154	181		222	76	101	139	105
SVE	186				177	140	231	148
UK	137	89		98	109	171	173	131
Source: EU-FADN - DG AGRI G-3.								

Table 4.6 also shows large differences in the volatility in the field crops sector. The Netherlands has the highest volatility, followed by Sweden and Luxemburg. The coefficient of variation in the field crops sector is further specified in the next chapter. Besides climatic conditions the differences are explained by the differences in cropping patterns. For example in the Netherlands potatoes and onions are important products. These products (except for starch potatoes) are hardly regulated by the CAP. Therefore changes in yields, due to heavy rainfall, crop diseases, draught or other conditions, have a strong impact on the price level and on the revenues and profits of farms. Besides the cropping pattern, also the (financial) structure of the farm is important. Although the arable farms in southern Europe have more unpredictable yields due to climatic conditions and especially drought, this figure shows that farm incomes in northern Europe are more volatile.

One of the aspects of the financial structure of the farm is the differences in the distribution of the net value added (NVA) among the different stakeholders. There are sharp differences in the percentage of net value added going to banks or other lenders and to the rent of land (table 4.7). Also the amount of paid labour differs among countries. The fact that family farm income is a residual factor makes it more volatile compared to the enumeration of other stakeholders (figure 4.5).

Figure 4.5 **Farm output, value added and family farm income**

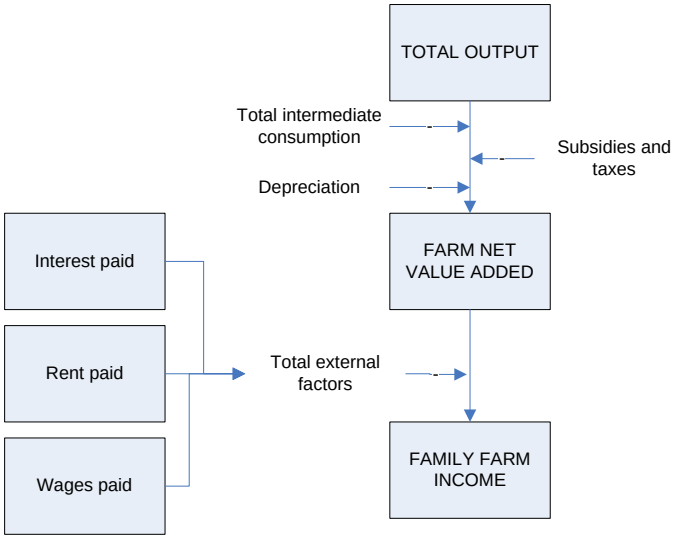


Table 4.7	Distribution of net value added to stakeholders at the average farm (average 2002-2004) a)			
Country	% of NVA distributed to different stakeholder			
	Interest to banks and other lenders	Rent to land owners	Wages to labour	Residual income to farm households
Belgium	12.5	9.4	9.8	66.4
Denmark	51.9	13.7	30.8	4.1
Germany	9.3	19.9	25.5	42.7
Ireland	4.8	9.9	6.4	78.2
Greece	0.4	6.2	7.7	85.9
Spain	0.9	3.6	13.2	82.0
France	8.6	18.6	18.2	57.4
Italy	0.7	4.8	14.7	80.2
Luxembourg	10.3	13.4	8.2	67.7
Netherlands	22.1	10.9	30.0	35.2
Austria	5.2	5.9	3.9	80.3
Portugal	1.6	4.7	21.9	77.8
Finland	8.1	8.6	12.3	71.4
Sweden	27.1	22.5	26.0	24.4
UK	8.2	14.1	31.5	46.7

a) NVA definitions as used in national micro-economic information systems.

5 Volatility of farm incomes in the field crops sector

5.1 Introduction

This section presents the volatility of incomes and the financial results of farms specialised in field crops. Field crops include a wide range of crops such a wheat, barley, maize, rye, colza, sunflower etcetera. An important group of farms within the field crops sector are specialised in the production of cereals. Field crop farms cover 40% of the European Union's utilised agricultural area. Since 1992, they have been eligible for a hectare-based community aid-scheme (including set-aside measures for land). It is important to notice that the number of 'field crop farms' in the total farm population (according to FADN) is very different per member country. Countries with the highest percentages of these farms - close to 40% or more - are Italy, Denmark[1], Greece and Portugal. In France, Germany, the UK, Spain, Austria, Finland and Sweden, between 20 and 30% of the farms are specialised in field crops. In the Netherlands and Belgium the figure is near 15%. Ireland and Luxemburg hardly have any field crop farms. The number of observations in FADN is therefore too low to report on these countries, and for this reason the results are not presented here. In some countries only a small part of the field crops farms are specialised in cereal production. This will be taken into account in the analyses of incomes.

5.2 Evolution of incomes

Most countries show a favourable development of incomes for arable farms in nominal terms (table 5.1). The development of average incomes in the different Member States are quite different. In Spain and Germany the increase in incomes was very strong. Farmers in the UK received lower nominal incomes at the beginning of the new millennium. The level of average income in the field

[1] The case of Denmark shows that field crop farms can be less dependent on field crops than the name suggests. Some Danish farms use their cereals to feed their pigs, which means that in their output (and income volatility) they are more like mixed farms but in the segmentation the cereal growing is taken into account.

crop sector per country is very different. Belgium and the Netherlands have the highest incomes, followed by France, the UK and Germany. In Denmark as well as in Sweden the average income is very low (close to or just above zero).

For field crop farms, in most countries, the average income is developing steadily. The Netherlands is however an exception. The very low incomes in 1992 (€6,200) and the high level in 1994 (€64,000) are examples of the large fluctuations, mainly caused by the different levels of potato prices per year (a crop not regulated by the CAP and with a strong business cycle).

Figure 5.2 illustrates the large differences between farms within countries. The lower end of the bar displays the fifth percentile. The upper end of the bar represents the ninety-fifth percentile. The mark within the bar displays the median income. The Netherlands shows the largest range of farm results. 5% of the farms achieve incomes higher than €150,000. At the other end 5% of the farms have a negative income of more than €80,000. The median value is just above zero. Other countries with quite a large range and a substantial percentage of negative incomes are Germany, the United Kingdom and Sweden. Besides structural differences, also management skills are an important factor in explaining these differences.

Figure 5.2 **Distribution of family farm income on specialised field crop farms, 2002**

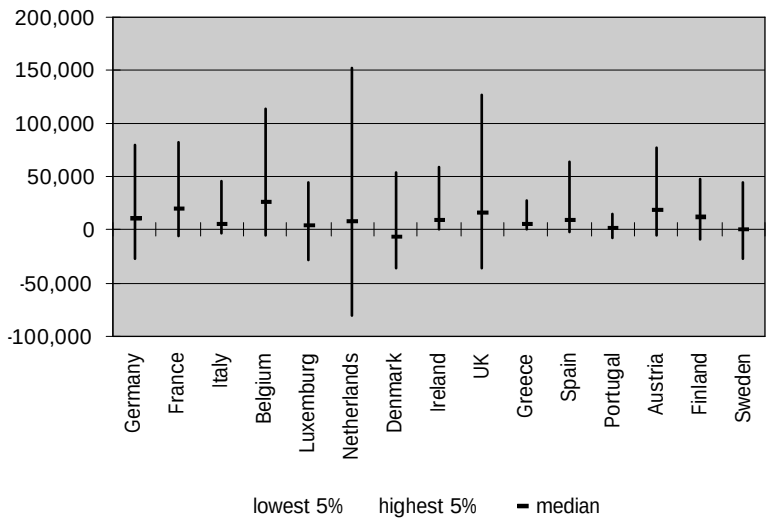
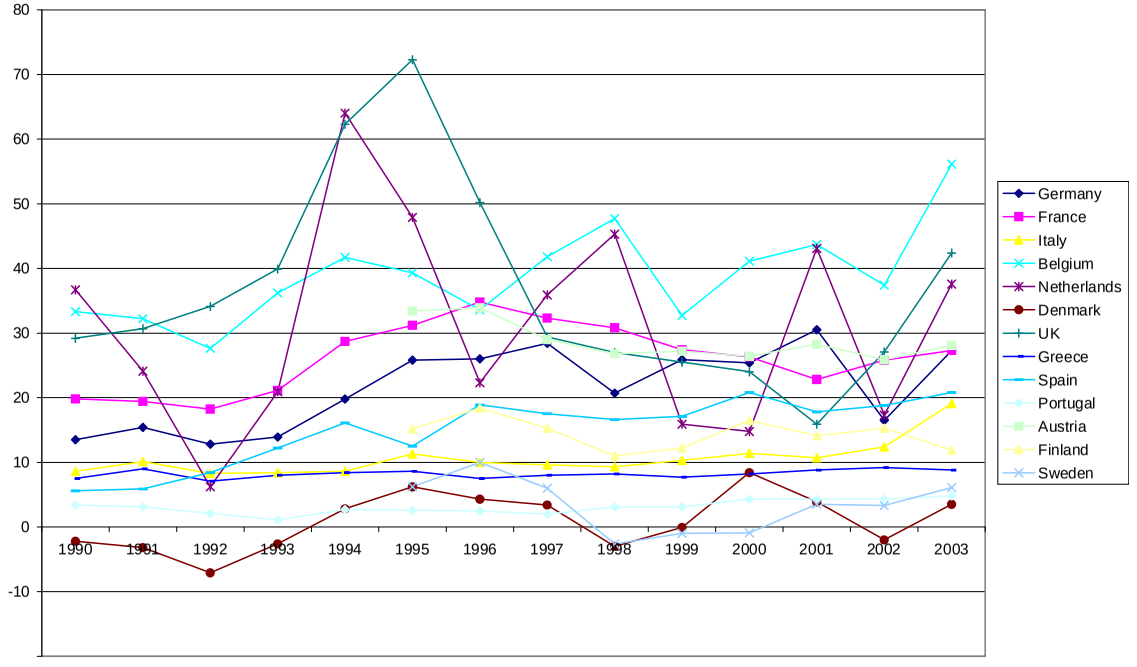


Figure 5.1 **Fluctuation in average family farm income of arable farms**



5.3 Evolution of income of cereal farms

As mentioned in the introduction, there are hardly any specialised cereal farms in the Benelux countries. Consequently, developments in the remaining 12 member countries are described in this section.

Table 5.2 and figure 5.3 present the average income of cereal farms from 1990 to 2003. It is striking that from 1994 on in most countries the levels of incomes of the cereal farms are much higher than in the years before. The introduction of payments per hectare of cereals had, at least at first instance, a positive impact on the incomes of cereal growers. Changes in the number of cereal farms in some countries (Germany, Italy and France) also influenced the results. This is explained later on in this section - see 'Structural developments'.

For the whole period Germany, Spain and Portugal show a very positive income development. The enormous increase in Germany is mainly explained by the low incomes at the beginning of the nineties. Furthermore, these countries were able to reduce the costs as a share of total revenues. In other countries the picture is less favourable. Nominal incomes in France and Ireland hardly increased. In the UK and Greece they even went down, due to an increase in costs. For Denmark and Sweden it is clear that the income level of cereal growers is low, having been negative for several years.

Figure 5.4 illustrates the spread in incomes in the different countries. Incomes of cereal producers show considerable differences. The range is especially large in the UK. The bar displays the range of incomes of 90% of the farms in the country. This means that still 5% have a farm income higher than the top of the bar, and 5% have an income of less then the lowest value in the bar. The tick mark in the bar displays the median value, which means 50% of the farms have a lower income and 50% of the farms have a higher income. In some countries, especially Greece and Portugal, the difference is rather small, less than €50,000, but still large compared to the average income. In Denmark, with on average a low income in the cereal sector, even more than 50% of the cereal farmers had negative results.

Figure 5.3 **Fluctuation in average family farm income of specialised cereal farms per country per year (x €1,000)**

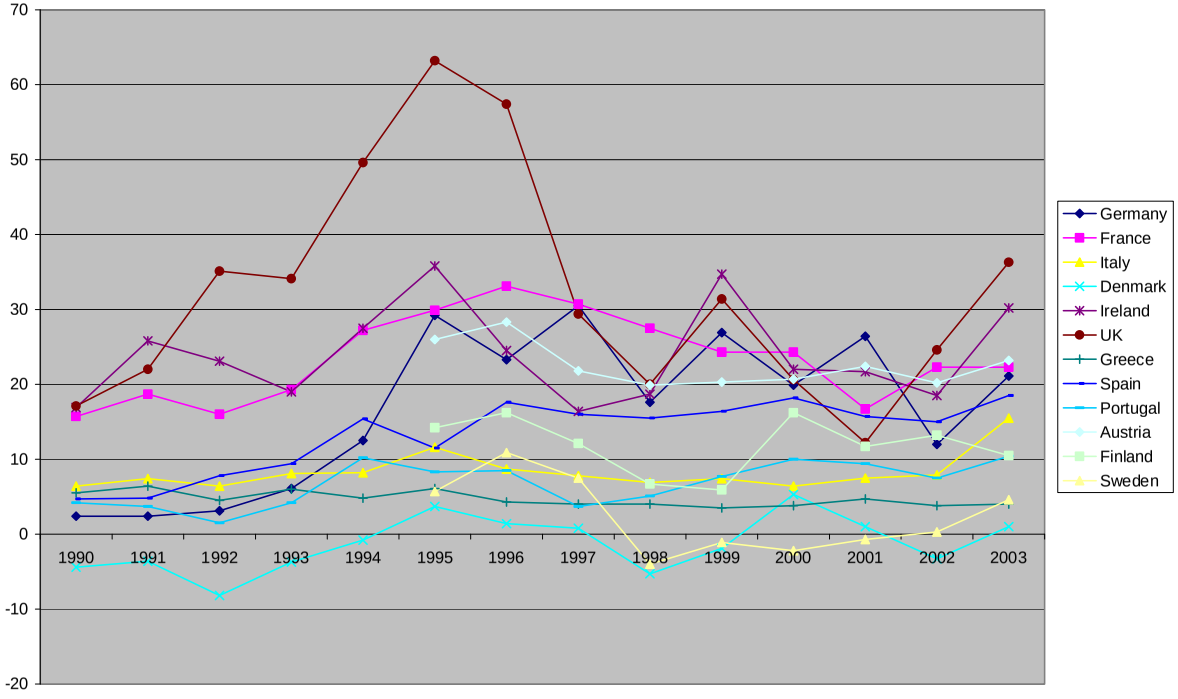
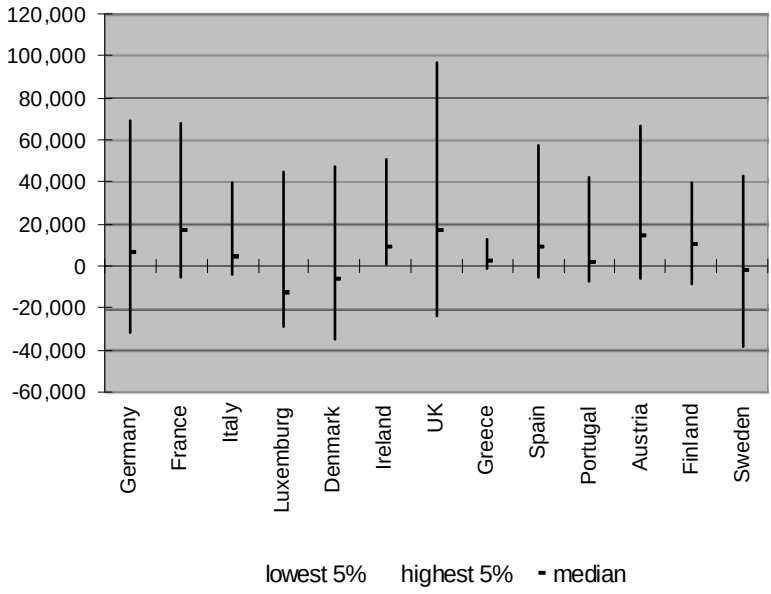


Figure 5.4 **Distribution of family farm income on specialist cereals farms, 2002**



5.4 Structural developments cereal farms

Farms specialised in cereal production are concentrated mainly in Italy, France and Spain (table 5.3). The number of farms per member country per year with this specialisation fluctuates. For instance in France, Italy and the UK the number increased in 1994 as a result of the recalculation of SGM (standard gross margins per crop and animal used for typology of farms) combined with improved actual data on the acreages of crops etcetera per farm (farm structure survey). For Germany data of farms in the (new) regions (in East Germany) were added in 1994/1995. This also caused a strong increase in the average scale of production (in ESU as well as hectares). To take these fluctuations into account we will mainly look at the longer trends.

Table 5.3 shows a strong increase in the number of specialised cereal farms in most member countries, except in Portugal. Only in Denmark the number of these farms remained almost unchanged. Given the (strong) decrease in farms

Table 5.3 Farm structure of specialised cereal farms per country

	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average size (ha)		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	21.5	13.9	103.2	16.9	1.95	6.3	155.0	13.2	802	12.3	82.7
France	71.8	8.2	67.7	4.4	1.40	0.7	103.1	3.2	215	1.9	61.7
Italy	106.1	3.7	16.7	3.5	1.08	-1.3	24.4	1.5	366	9.5	99.2
Denmark	13.7	-0.2	37.9	6.8	0.77	3.5	54.7	6.1	650	14.3	53.2
Ireland	3.1	5.0	45.3	1.8	0.96	-0.2	77.1	-0.4	1009	7.0	97.7
UK	20.2	7.6	110.2	5.8	1.79	-0.9	173.2	2.6	1252	6.3	89.1
Greece	37.2	4.2	7.7	2.2	0.72	-6.6	14.3	-0.4	60	-1.1	99.3
Spain	95.0	0.8	20.8	5.3	0.93	0.7	67.4	1.8	201	3.1	97.8
Portugal	3.4	-11.3	11.7	7.0	1.24	-1.2	48.8	4.1	92	4.5	97.7
Austria	5.7		21.8		0.98		50.9		290		90.5
Finland	12.1		19.2		0.76		59.0		244		80.5
Sweden	7.6		31.8		0.86		98.4		415		72.1

Source: FADN-CCE-DG Agri; adaptation by LEI.

at a national level, we can conclude that the share of specialised cereal farms has increased, also in Denmark.

The average size (in ESU) of the cereal farms in southern member countries (Greece, Italy, and Portugal) is far below the average size in the other countries (table 5.4). The UK has still by far the largest cereal farms. Cereal farms in the countries which joined the EU in 1995 - Austria, Finland and Sweden - are on the other hand rather small. In all countries the average size of the cereal farms increased. In countries like Germany - after reunification - Denmark, Portugal, the UK and Spain this growth was rather strong. The other countries showed a small increase in the average farm size.

The number of workers on cereal farms in most countries did not really change (table 5.3). Germany is in an exception to this, caused by the addition of larger farms in the new Bundesländer. Also Denmark shows a significant increase. On average the farms in Germany have the highest labour input, slightly higher than the large farms in the UK, with on average 2.0 agricultural work unit (awu). Most other countries have around 1 awu per farm.

The amount of assets per farm increased in most of the member countries very strongly (table 5.3). The assets increased especially in Germany, Italy and Denmark. Greece, with a further decrease, and Portugal, with an increase, remained at relatively low levels. The solvability of farms did not change much. In combination with the strong increase in assets in some countries this implies that the own assets increased in these countries.

The acreage of cereal farms per member country is still very different (table 5.3). In most countries the acreage increased. The UK maintained its top position with the largest farms. Next to the UK is Germany. The accession of the East German regions resulted in a strong growth of the average farm. France, Spain, Portugal and Denmark show a more gradual growth.

Given the strong development in the size of farms (in ESU, in hectares and in assets) and the almost stable number of labour units we can conclude that the productivity per labour unit has increased strongly.

5.5 Development of prices and productivity

The developments of the average prices of wheat, the main cereal crop in the EU, per year are shown in table 5.4. These prices are the prices as received by farmers, reflecting differences in quality, storage, bulk-delivery etcetera. It shows that the prices went down in 1993 in line with CAP Reform decisions. In the following years the fall in prices was more gradual. In most countries it re-

sulted in a price decrease of 30%. This is also in line with CAP Reform decisions in 1992. Portugal suffered a larger decrease in wheat prices, starting from a much higher level in 1990 than in other countries. Wheat prices in the different member countries at the end of the period are comparable. Italy and Greece however still have a higher level of prices, which reflects the higher prices of durum wheat in these countries.

The yields per hectare in most member countries increased in the nineties (table 5.5). In general the yields in the northern countries, including France, are higher as well as more stable over the years than in southern countries. Fluctuating yields in southern member countries, for instance in Portugal, are caused by better climatic conditions in some years, or droughts in others.

5.6 Development of prices and productivity of other arable products

This section describes the productivity and prices of some other arable products. Table 5.6 shows the average price of potatoes received by crop farmers per country per year. In these tables potatoes are a combination of starch potatoes, seed potatoes and potatoes for consumption. Table 5.7 shows the development in the yields in the different member states. It shows quite strong fluctuations in the average yields. This does not directly mean that revenues show similar fluctuations. There is a clear negative correlation between the physical yields and the prices. For example, the year 1998 in the Netherlands shows the lowest yields per hectare during the whole analysed period. During the same year, this low yield resulted in the highest prices. The correlation between prices and yields is close to -0.7 in the Netherlands and Belgium. On the other hand the correlation in Spain and Portugal is very low (-0.05 and -0.08).

5.7 Regional results for cereal farms

Table 5.8 shows results for important cereal growing regions in Europe. The selection has been made based on the number of farms and the total economic value of the sector (sum of ESU of all farms). Farms in Denmark are quite different from farms in most other regions. In 2002 they had on average negative incomes, whereas these farms had the strongest volatility of incomes during the period 1990-2003. They also have a relatively high share of borrowed capital with a solvability of 56%. This is especially low compared to some regions in the south, where the solvability is close to 100%. Regions with a low volatility of incomes are

Castilla-La Mancha and Centre. A major difference between farms in these regions is the average solvability, which is much higher for farms in Castilla.

5.8 Within-farm volatility of farm incomes on specialised field crop farms

Table 5.8 also shows large differences in the volatility in the field crops sector. The coefficient of variation in the field crops sector is further specified in figure 5.5. Besides climatic conditions the differences are explained by the differences in cropping patterns. For example in the Netherlands potatoes and onions are important products. These products (except for starch potatoes) are hardly regulated by the CAP. Therefore changes in yields, due to heavy rainfall, crop diseases, draught or other conditions, have a strong impact on the price level and on the revenues and profits of farms. Figure 5.5 clearly shows that there can be large differences within a country, and even within one specific type of farming. Besides the cropping pattern, also the (financial) structure of the farm is important. Although the arable farms in southern Europe have more unpredictable yields due to climatic conditions and especially drought, this figure shows that farm incomes in northern Europe are more volatile.

Table 5.8 Specialised cereal farms in important cereal regions, 2002

Name	Number of farms	ESU	Ha	Family farm Income (€)	Volatility 1990-2003	Assets	Solvability	Price	Yield/ha
Castilla-Leon	32,510	22	69	11,266	47.9	186	96	13	2,811
Veneto	20,920	17	13	7,212	37.5	617	100	13	5,708
Castilla-La Mancha	19,540	19	65	19,125	22.1	277	99	13	3,692
Lombardia	13,610	30	26	12,661	29.8	900	100	14	6,027
Denmark	14,590	30	47	-3,316	93.4	538	56	10	6,922
Centre	12,450	85	129	29,095	27.8	255	58	10	7,699
East England	12,070	132	174	29,862	44.4	1,389	90	10	8,289
Midi-Pyrenees	8,170	58	89	2164	52.3	207	69	13	5,492
Poitou-Charentes	7,660	62	100	23,566	31.0	188	56	10	7,041
Champagne-Ardenne	4,450	91	130	27,035	33.7	251	58	9	7,941
Bourgogne	4,420	88	147	26,028	39.8	245	57	10	6,997
North England	4,030	102	138	27,840	43.8	993	86	10	8,847
West England	3,850	91	149	20,059	87.8	979	90	10	7,750
Picardie	3,380	98	119	24,543	48.8	288	45	10	8,521

Source: FADN-CCE-DG Agri; adaptation by LEI.

Figure 5.5 **Volatility of family farm income per region**

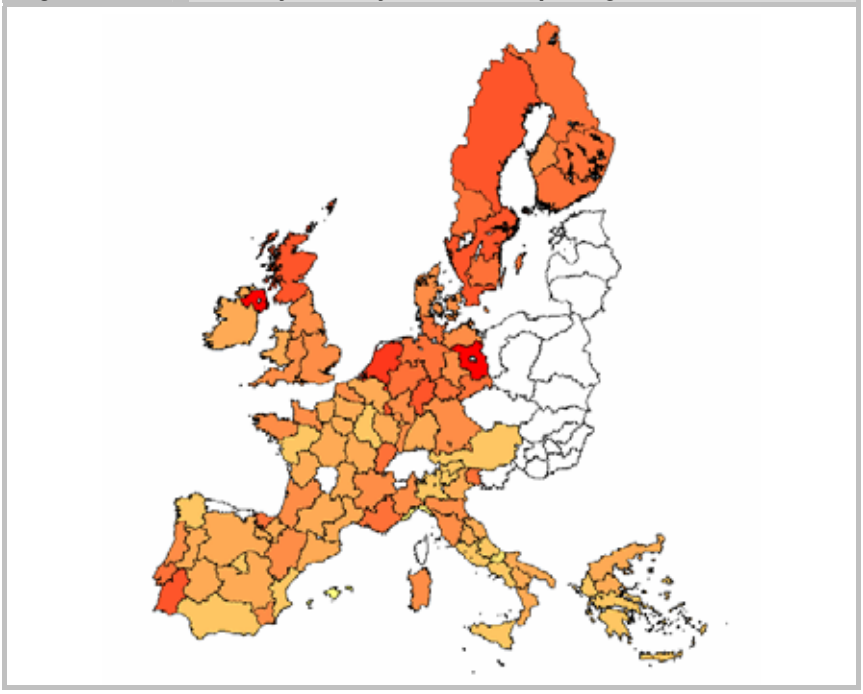
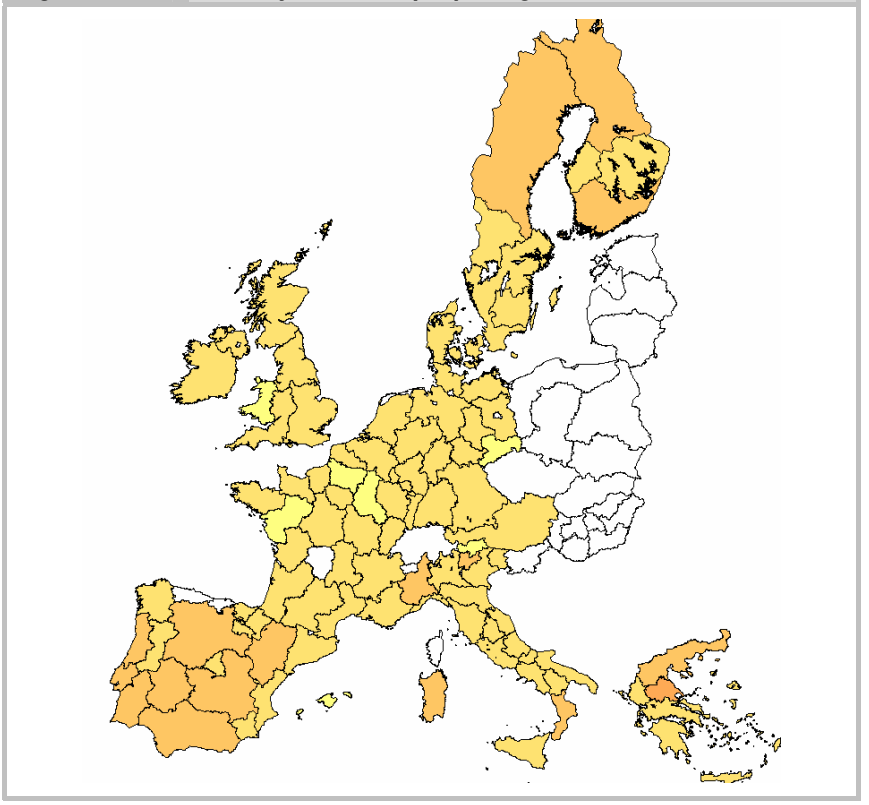


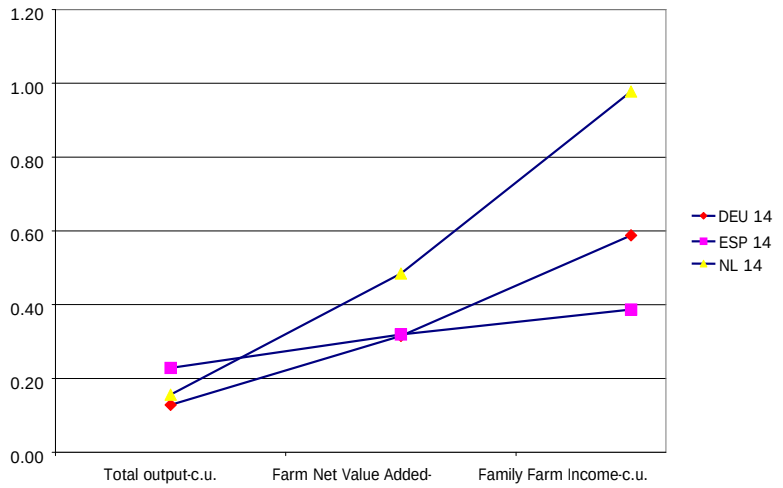
Figure 5.5 presents the coefficient of variation for the different regions in Europe. The values reflect a combination of factors, such as: the climatic conditions, occurrence of diseases, the type of farming prevalent in the region, crops and animal products produced etcetera. The highest volatility of farm incomes can be found in the north-western part of Europe. This contrasts with some previous research and expectations with respect to the climatic circumstances in different parts of Europe. Therefore figure 5.6 presents the volatility of total output. This pictures shows that the output volatility, which is conceptually more correlated with the production circumstances, is higher in the southern European countries and to a lesser extent in the Nordic countries. Comparison of both figure 5.5 and figure 5.6 reveals that the volatilities of farm income are much higher than those of production value. Farm income is much more volatile because it is a residual indicator. More specific analyses have shown that although the production volatility in Spain is higher than in Germany or the Netherlands, the volatility in net value added or family farm income is higher in the latter. This is mainly caused by the differences in the (financial) structure of farms.

Figure 5.6 **Volatility of total output per region**



The next figure 5.7 illustrates these differences. Although the volatility of production (total output) is the highest in Spain, the volatility of farm income is the lowest in Spain. This is strongly related to the distribution of the net value added among stakeholders (as described in chapter 4). In all three countries the volatility of total output is lower than the volatility of net value added and much lower than the volatility of farm income. Farm income is a residual factor and therefore the most volatile. In Spain the share of net value added going to the farm family is much higher than in Germany and the Netherlands.

Figure 5.7 **Volatility of output, net value and income on field crops farms in Germany, the Netherlands and Spain**



5.9 Income crisis on specialised field crop farms

As illustrated in this report there are large differences between farms. Also, the possibilities of farms to cope with the occurrence of external events differ strongly. Shortfall risk will be specified as the percentage of farms in a region or in a country that will have a farm income of less than zero due to a price or revenue decrease as a consequence of a possible crisis. A distinction is made between including and excluding opportunity costs. Cost of own labour is calculated as the average of paid labour in a specific region (Niemi and Ahlstedt, 2007), cost of own assets is calculated as 4% of own equity. The analysis focuses on farms that were in the sample for the three succeeding years 2002-2004. For every farm, the normal uncertainty in the revenues was calculated. Based on the financial structure of the farm an analysis was made how robust a farm would be to survive an external event that would reduce the output value with 30%. In order to show the robustness of the farm itself, the assumption was made that there are no indemnity payments and that the external event does not change the cost structure of the farm. To establish the financial robustness of farm, farms were categorised into five categories:

- Family farm income is higher than opportunity costs;
- Family farm income is still positive after the external event;
- Family farm is negative, but postponing redemption (assumption: redemption equals depreciation) is an option;
- Family farm income cannot be compensated with postponing redemption. Unless the farmer has liquidities to compensate for the negative income, financial distress will be the result;
- Family farm income is already negative before external shock; the external event only deteriorates the situation.

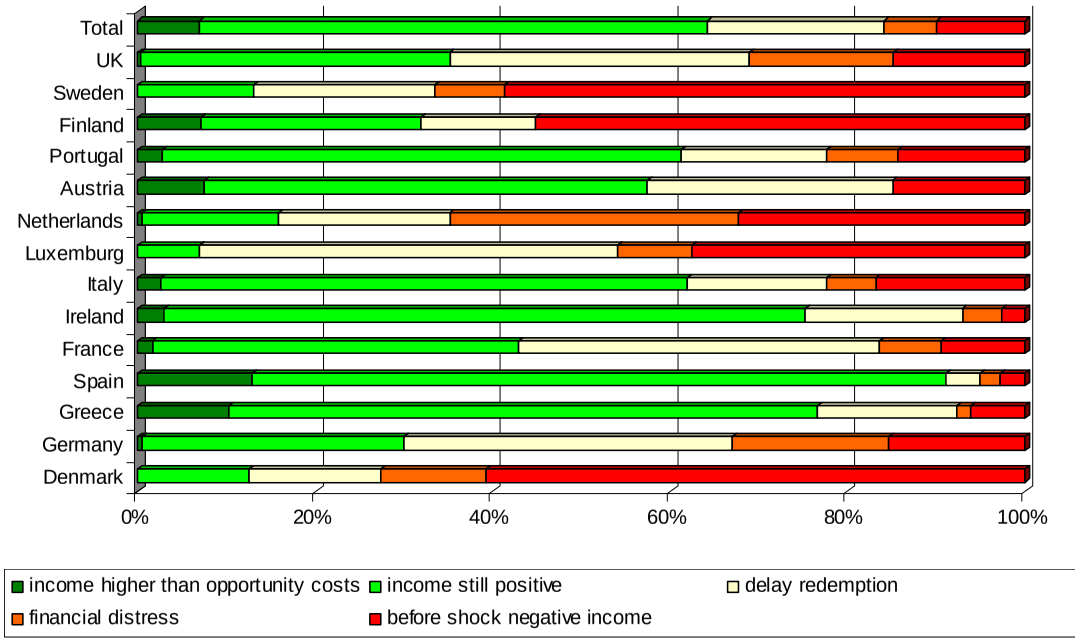
The results for the specialised field crop farms are displayed in figure 5.8. There are clear differences in the financial robustness of farms. Countries such as Spain, Ireland and Greece have a percentage of farms with a positive income after an external shock far above the European average. In countries such as Sweden, the Netherlands, Germany and Denmark and to a lesser extent Finland and the UK the number of farms with a positive income after the shock is much lower than the European average.

Whether financial distress leads to the bankruptcy of the farm depends on many other factors such as the farm wealth, the off farm wealth, the off farm income etc. These graphs show that although agriculture in Southern Europe is more vulnerable to drought, the financial risks are larger in North-Western Europe due to small margins. So, although the climatic conditions have an impact on the volatility of production, the volatility of farm incomes is strongly affected by the (financial) structure of the farm. These structures are also dependent on the risks that farmers have learnt to cope with. Further analyses - not reported here - have shown that there is no strong link between the size of the farm and the extent to which a farm can cope with an external crisis.

5.10 Example of volatility: harvest problems in 1998 in the Netherlands

A large part of arable farmers in the Netherlands, around 60% of them, were confronted in the autumn of 1998 (September, October) with too much rain to harvest their crops, mainly potatoes and onions. As a consequence 30% of the area of potatoes was not harvested. The rainfall in these months was the largest in the 20th century, especially in the two regions in the Netherlands that are important for the production of potatoes. Potatoes are of major importance to the Dutch arable sector. In normal years, about 40-50% of the returns of arable farms come

Figure 5.8 **Financial robustness of farms after an external shock**



from potatoes (ware potatoes, plant potatoes and starch potatoes[1]). On average around 30% of the acreage of arable farms is planted with potatoes.

Under these extreme conditions, prices of ware potatoes became 100% higher during the marketing year 1998 than under normal climatic conditions (see figure 3.2 in chapter 3). The returns of ware and plant potatoes were on average 40% or €18,000 per farm higher than in normal years. The average result of arable farms in 1998 improved for a large part as a consequence of these higher prices of potatoes (and onions), but also due to the compensation for harvest losses (De Bont, 2000). The average family farm income on arable farms was clearly higher than in the previous two years and much higher than in the next two years (1999 and 2000).

The extreme harvest conditions caused a somewhat larger dispersion of incomes in the arable farm sector than in normal years (table 5.9). The dispersion is influenced by the regulations to compensate farmers with a severe damage (if more than 30% of the area of a crop was not harvested). On average arable farmers received €20,000 as compensation for the suffered damages. The compensation per hectare was based on the normalised returns of FADN data of LEI. In the marketing year 1998/1999 many farmers were overcompensated (Van Bommel et al., 1999). The average income in 1998 of farmers receiving compensation was above the normal level. On average arable farmers received a higher income. On an individual level around 35% of the arable farmers who received compensation still had a lower income than under normal conditions. This was especially true for producers of starch potatoes, who did not profit from higher prices for this product. Prices of starch potatoes are less dependent on the market, but are more influenced by the CAP. Other farmers with a lower income were producers of consumption potatoes with a high percentage of their area not harvested.

Conclusion

This case shows that due to extreme climatic conditions prices of (arable) products may increase resulting in higher incomes for most (arable) farmers than under normal conditions. However, part of the (arable) farmers had incomes that were lower than in normal years. The dispersion of incomes is influenced by the compensation of the government for the harvest losses. Due to this com-

[1] Prices of potatoes for starch are supported by the CAP under the market regulation of cereals; plant potatoes and ware potatoes are not supported by CAP.

pensation the effect of the climatic conditions on the dispersion of incomes is somewhat limited.

Table 5.9 **Distribution of family farm income of arable farms (in Dutch guilders)**

	1997/98	1998/99	1999/00	2000/01
Less than 0	11	6	22	25
0-25,000	22	23	29	30
25,000-50,000	15	17	21	22
50,000-75,000	14	12	15	14
75,000-100,000	6	10	5	4
100,000-150,000	22	14	5	3
More than 150,000	11	18	3	2
Average income	72,800	89,400	24,000	14,000

Source: FADN-CCE-DG Agri; adaptation by LEI.

5.11 Example of volatility: The impact of a warm and dry summer on cereals in France

During the spring and summer period of 2003 temperatures were relatively high and there was a lack of rain in a large part of Europe, also in the north western part of the continent. This affected the harvest of cereals: the crops ripened faster and were ready to be harvested at an earlier moment than normal. This resulted in yields (kg of product per hectare) lower than expected. At a first glance, this seems to be a negative situation for farmers. Besides the premium per hectare - at that time still coupled to production, the decisions on decoupling were only made in the summer of 2003 -, farmers expect a minimum yield to maintain their level of income.

Given the CAP on cereals, farmers do not expect higher prices for their cereals than in normal years; prices are in general just above or equal to the intervention price level (some €10 per 100 kg). In the frame of Agenda 2000 farm ministers had decided in 1999 to decrease the intervention (minimum) price levels of cereals by 15% in the period 2000-2002. This decrease was compensated by an increase of the premium per ton with €18 to a level of €63 per tonne. Set aside of land, introduced at an earlier stage in the CAP, was maintained at a level of 10% of the land for farms with more than 20 ha of 'premium crops' (cereals, oilseeds and proteins).

Selected regions and farms

The selected regions (Ile-de-France, Champagne-Ardenne, Picardie and Centre) are important in cereal production in France. FADN data of 300-600 specialised cereal producing farms (type 131) in these regions are available for the years 1990-2003. These farms represent some 15.000-20.000 farms in these regions for the years mentioned. On these farms the production of cereals (mainly wheat and barley) accounts for some 60% or even more of the total area of the farm. The average area per specialised cereals farm in these regions has increased in the period 1990-2003 from about 80 to more than 100 ha. The area of wheat is on average 40-50 ha per farm in the regions mentioned. The area of barley is much smaller, on average about 15 ha.

Results

Yields of wheat and barley (in kg per hectare) were in 2003 significantly lower than in the years before (table 5.10 and 5.11). Only in Picardie the decrease of the yields was relatively small, for wheat as well as for barley.

Prices of wheat and barley in 2003 were higher than in 2002 (table 5.12 and 5.13). However, the prices for wheat and barley in 2003 were in many cases lower than the average prices of these products in the years 1990-2003 as well as in the specific years before 2002. The impact of the CAP Reform in 1992 as well as the decisions on Agenda 2000 in 1999 is clear: it was decided to reduce the intervention prices of cereals by 30% during the period 1993-1995 and 15% during the period 2000-2002. As far as the extreme weather conditions in 2003 have influenced the prices of wheat in barley in 2003, the data per region show a quite large variation. Wheat price increases in Ile-de-France and in Centre were much higher - more than 2 eurocents, about the average in France - than in the other regions. On barley however the average price increase in 2003 compared with 2002 was lower (about 1 eurocent). For barley the strongest price increase was in the region Centre.

Table 5.10	Yields (kg per hectare) of soft wheat on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	7,292	7,770	8,886	8,514	8,111	7,446	7,932	6,690	7,719
Champagne-Ardenne	7,991	7,534	8,605	8,293	8,374	7,107	7,940	6,289	7,581
Picardie	8,753	7,818	9,084	8,768	8,213	7,988	8,522	7,868	8,151
Centre	6,403	6,975	7,890	7,368	7,270	6,595	7,748	5,789	6,954
France	6,938	6,743	7,867	7,398	7,409	6,718	7,590	6,096	7,003
Source: FADN-CCE-DG Agri; adaptation by LEI.									

Table 5.11	Yields (kg per hectare) of barley on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	6,199	6,672	7,060	6,475	6,409	5,410	6,559	5,909	6,262
Champagne-Ardenne	6,493	6,756	7,364	7,020	7,286	6,466	7,057	5,808	6,544
Picardie	7,517	7,130	7,720	7,761	7,261	6,959	7,753	6,822	7,160
Centre	6,156	6,186	6,907	6,603	6,519	5,812	6,907	5,462	6,225
France	6,171	6,146	6,817	6,464	6,578	5,748	6,762	5,522	6,136
Source: FADN-CCE-DG Agri; adaptation by LEI.									

Table 5.12	Prices of soft wheat (euro per 100 kg) on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	13.17	12.13	10.66	10.90	10.28	11.16	9.91	12.17	12.37
Champagne-Ardenne	12.60	11.53	10.36	10.60	9.46	10.63	9.40	10.93	11.34
Picardie	12.62	11.62	10.28	10.56	9.93	10.95	9.57	11.01	11.27
Centre	12.99	12.22	10.60	11.15	10.74	11.44	9.83	12.74	12.54
France	12.96	12.02	10.63	10.93	10.34	11.20	9.78	11.82	12.00
Source: FADN-CCE-DG Agri; adaptation by LEI.									

Table 5.13	Prices of barley (euro per 100 kg) on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	13.01	11.50	11.25	11.36	11.39	11.28	10.46	11.26	12.71
Champagne-Ardenne	12.95	11.42	10.77	10.47	10.53	10.43	9.22	10.21	11.39
Picardie	12.94	11.44	10.71	10.68	10.61	10.48	9.04	9.90	11.35
Centre	12.60	11.61	10.70	10.98	11.00	10.88	9.70	11.40	12.05
France	12.74	11.53	10.65	10.77	10.81	10.76	9.54	10.66	11.70
Source: FADN-CCE-DG Agri; adaptation by LEI.									

As a result of the lower yields in kg per hectare and the higher prices of cereals in 2003 the returns on cereals in 2003 were lower than in 2002 (table 5.14 and 5.15). Only for barley in Champagne-Ardenne the return was higher. Compared with the returns of wheat in the years before 2002, the returns in 2003 were lower. For Picardie the returns on wheat in 2003 were also lower than the long-term average (1990-2003). For barley the picture is less clear: in the region Champagne-Ardenne the returns in 2003 were higher than in 2002 and in the region Picardie the returns in 2003 were above the long-term average (1990-2003). A major factor in this is the strong increase of the average barley area per farm in Champagne-Ardenne (with more than 10%) in 2003.

Despite the lower returns on cereals, farm incomes on the specialised cereal producing farms in 2003 were higher in all selected regions than in 2002 (table 5.16). Except for Champagne-Ardenne, the incomes in 2003 of this type of farms in the selected regions were above the average of the period

Table 5.14	Returns of soft wheat (euro) per farm on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	51,723	51,713	52,838	51,692	47,436	46,475	53,515	48,837	51,096
Champagne-Ardenne	43,028	36,973	38,663	37,672	35,231	32,103	30,921	27,011	34,848
Picardie	53,690	44,583	47,647	48,811	45,638	46,515	45,404	44,971	44,706
Centre	38,377	40,442	40,055	40,511	39,222	31,483	37,692	35,017	38,461
France	28,145	26,257	26,864	25,449	24,747	21,179	24,824	21,619	24,774

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.15	Returns of barley (euro) per farm on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	10,977	11,542	12,259	11,494	11,800	11,111	11,917	11,696	11,592
Champagne-Ardenne	18,053	18,553	19,781	18,281	19,169	20,473	19,946	20,661	18,409
Picardie	12,572	11,402	10,336	9,634	10,137	12,051	10,467	9,892	11,022
Centre	8,748	9,561	8,540	8,510	8,903	9,722	10,899	10,653	8,616
France	6,767	7,220	6,681	6,008	6,384	6,789	7,241	7,099	6,538

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.16	Family farm income on specialised cereal farms in France in 1996-2003								
Region	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**Average 1990-2003**
Ile-de-France	40,832	41,939	34,911	34,093	26,226	19,348	25,235	32,810	30,491
Champagne-Ardenne	44,363	41,705	37,851	32,187	34,084	27,758	27,035	29,689	32,710
Picardie	45,701	35,992	31,118	30,219	23,955	23,570	24,543	31,181	27,326
Centre	33,171	37,537	30,874	30,336	25,867	17,014	29,095	30,905	27,651
France	33,210	30,767	27,525	24,356	24,252	16,440	22,297	22,325	24,392

Source: FADN-CCE-DG Agri; adaptation by LEI.

1990-2003. For all specialised cereal producing farms in France however incomes in 2003 were below the average of 1990-2003.

Conclusions
The lack of rain and high temperatures in 2003 resulted in lower yields and returns on cereals in the selected major cereal producing regions in France. The increase of cereal prices did not compensate the fall in yields per hectare. However, the lower returns on cereals did not result in lower incomes on the specialised cereal producing farms in the selected regions. The reasons are not fully explored in this study, but one of the reasons is a higher return for other field crops, for instance for potatoes. Given the lower yields of potatoes and the lower supply on the European market, prices of potatoes were much higher in 2003 than in the years before.

5.12 Example of volatility: The impact of a long drought period in Spain on cereals

In a number of regions in Spain, farmers had to deal with a lack of rain during a relatively long period, from 1993 to 1995. In fact, during the years 1994 and 1995 the production and harvests were even affected by drought. In some regions yields (in kg per hectare) were lower than under normal conditions. It is interesting to see whether incomes were affected by the drought in these years. In the analysis it has to be taken into account that in the years 1993-1995 the CAP for cereals was reformed. Intervention prices were decreased with some 30% and farmers received the introduced European compensatory premiums per hectare (€ 45 per tonne, the yields for the premium were fixed on a reference per region). A condition for this premium was the set aside of a part of the land by farmers with a production of cereals, oilseeds and proteins ('premium crops') above 92 tonne. In most years 10% of that land was under the set-aside scheme.

Selected regions and farms
The selected regions (Navarra[1], Aragon, Castilla-Leon, Castilla-La Mancha, Extremadura[1], and Andalucía[1]) represent a large part, more than 80%, of the spe-

[1] The number of farms producing barley and wheat in the sample in the period 1990-1995 was too low to have representative data. For this reason these regions are not taken in account in the analysis.

cialised cereal producing farms (type 131) in Spain. In most of the years 1990-2003 FADN data of about 1,000 or even some 1,300 farms of this type in Spain are available. However, in 1993 data from only about 550 farms are available. The FADN data set on this type of farms represents data of about 80,000- 100,000 farms in Spain.

Roughly 50% of the farms in the sample are producing wheat. Barley is produced by 70% of the farms in the sample. 70% of the total area of the farms in the sample (average about 65 ha) is planted with cereals. On average on an area of 40 to 45 ha of cereals about 25 ha is planted with barley and about 10 ha is planted with wheat. In fact barley is, in contradiction to the situation in France, more important than wheat on the analysed farms in Spain.

Results

The impact of drought in the years 1994 and 1995 on the yields of barley and wheat is larger in 1995 than in 1994 (table 5.17 and 5.18). This makes clear that the conditions to grow cereals worsened during the period of drought. In 1995 yields of barley are about 20-30% lower in the selected regions than the average yields for the years 1990-2003. In 1994 the yields were mainly lower in Aragon as well as in Castilla-La Mancha, but quite normal in Castilla-Leon. Yields of wheat in 1995 were about 30% below normal levels in Aragon and in Castilla-Leon. However, in Castilla-La Mancha yields were less depressed. The yields of wheat in 1994 were below normal levels mainly in Aragon.

Prices of cereals went down in the EU in the years 1993-1995 as a consequence of the CAP Reform in 1992. It seems that the drought and the lower supply had some positive influence on the prices, at least in 1995. The development of prices differs per region and per type of cereals (barley and wheat). Regional market conditions may be a reason for these differences.

The combination of the developments in yields, prices and acreage of barley and wheat result in the returns of these cereals per farm. The returns of barley as well of wheat in 1995 were much lower in Castilla-Leon compared with the returns in the year before (1994) and the following year (1996) as well as the average of the period 1990-2003. In the other selected regions the differences are somewhat smaller, for instance in Aragon on barley (table 5.21 and 5.22). Family farm incomes on specialised cereal farms in the selected regions as well as on average in Spain improved in the first year with an impact of drought on the yields: 1994 (table 5.23). But in 1995 incomes decreased in Castilla-Leon and on average in Spain.

Table 5.17	Yields (kg per hectare) of barley on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	2,468	2,591	2,855	2,677	1,857	1,975	2,700	2,599	2,744	2,580
Castilla-Leon	2,394	2,096	1,570	3,215	2,723	1,779	2,825	2,497	3,077	2,589
Castilla-La Mancha	2,179	2,248	1,993	2,417	1,955	1,628	2,159	2,241	2,649	2,382
Spain	2,308	2,278	2,152	2,773	2,348	1,717	2,641	2,434	2,835	2,538
Source: FADN-CCE-DG Agri; adaptation by LEI.										

Table 5.18	Yields (kg per hectare) of wheat on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	3,020	3,120	3,273	2,808	2,139	2,008	3,122	2,927	2,857	2,895
Castilla-Leon	2,585	2,205	1,514	3,370	2,883	1,817	3,107	2,632	3,344	2,774
Castilla-La Mancha	1,711	1,612	2,166	2,470	2,005	2,061	2,345	2,594	2,152	2,276
Spain	2,324	2,265	2,182	3,102	2,662	2,160	2,898	2,756	3,061	2,760
Source: FADN-CCE-DG Agri; adaptation by LEI.										

Table 5.19	Prices of barley (euro per 100 kg) on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	16.67	16.76	16.07	13.69	13.61	13.33	13.20	13.08	11.18	13.40
Castilla-Leon	17.01	17.09	16.73	14.26	13.61	14.35	12.68	12.82	11.67	13.01
Castilla-La Mancha	16.53	16.90	16.29	14.69	13.40	14.61	13.52	13.66	11.82	13.05
Spain	16.85	16.91	16.38	14.25	13.55	14.24	13.25	13.20	11.81	13.19

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.20	Prices of wheat (euro per 100 kg) on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	19.13	19.50	18.12	15.93	15.02	16.08	15.23	16.22	13.06	15.92
Castilla-Leon	18.87	19.76	18.30	15.70	15.33	15.85	14.29	13.83	13.31	14.11
Castilla-La Mancha	19.31	19.80	19.46	17.32	16.04	16.07	16.22	16.74	13.91	15.21
Spain	18.93	19.40	18.24	16.60	15.63	15.75	15.29	15.00	13.59	14.76

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.21	Returns of barley (euro) per farm on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	11,353	13,491	10,421	7,054	9,249	8,872	11,854	9,278	8,260	9,162
Castilla-Leon	14,046	11,802	6,550	8,800	12,947	9,412	14,855	12,131	13,735	11,164
Castilla-La Mancha	13,985	13,006	10,991	9,510	7,806	7,279	9,673	9,912	10,574	9,893
Spain	10,879	10,468	8,015	6,978	8,428	6,742	11,534	10,070	9,790	8,861
Source: FADN-CCE-DG Agri; adaptation by LEI.										

Table 5.22	Returns of wheat (euro) per farm on specialised cereal farms in Spain in 1990-1998									
Region	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**Average 1990-2003**
Aragon	2,946	3,815	5,540	3,810	1,533	1,637	3,334	2,493	1,570	2,489
Castilla-Leon	4,859	4,181	3,317	3,651	5,644	3,132	5,599	3,703	5,011	4,674
Castilla-La Mancha	3,532	2,017	1,058	1,549	1,634	1,424	1,016	1,642	1,045	1,703
Spain	3,541	3,462	3,290	3,151	4,356	3,481	5,290	3,935	3,286	3,654
Source: FADN-CCE-DG Agri; adaptation by LEI.										

Table 5.23 Family farm income on specialised cereal farms in Spain in 1990-1998

Region	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average 1990-2003
Aragon	6,204	5,731	10,111	8,283	13,818	16,861	19,691	13,435	11,249	11,995
Castilla-Leon	4,214	2,708	2,937	10,153	14,050	7,625	15,936	12,041	12,673	11,041
Castilla-La Mancha	5,148	6,561	10,243	12,932	14,102	13,929	17,410	19,913	19,294	16,785
Spain	4,793	4,691	7,606	9,339	15,286	11,436	17,498	15,938	15,534	13,596

Source: FADN-CCE-DG Agri; adaptation by LEI.

Conclusions

It is difficult to formulate conclusions on the impact of the drought in the years 1993-1995 on incomes of specialised cereal producing farms in the selected regions in Spain. The development of incomes is different per region. Furthermore, the development of incomes is influenced by the changes in the CAP during these years: a decrease of intervention prices, introduction of direct payments and restrictions on the production by set aside. The share of subsidies in the gross output of specialised cereal farms in Spain increased from about 12% in 1993 to about 30% in 1994 and 1995 (AGRI 141 EN, Brussels 2003). Moreover it has to be taken into account that the number of represented specialised cereal farms in Spain was much lower in 1993 than in other years and increased in 1994 with about 30.000 farms. The average farm size (in ESU and in hectares) in the sample of specialised cereal farms in 1994 was larger than in 1993 and the years before.

5.13 Conclusion for specialised field crop farms

The results of specialised field crop farms show an increase in incomes in the analysed period 1990-2003 in most member countries. The same conclusion can be drawn for the specialised cereal farms. Despite the decreased prices for cereals the incomes improved. The impact of the EU-premiums seems positive. Average incomes of arable farmers however fluctuated and the differences in incomes, at least in some countries (The Netherlands and the UK) are large. The volatility of incomes in the arable sector is rather high. Fluctuating prices of potatoes, a product not managed by the CAP, are one of the reasons for this.

6 Volatility of farm incomes in the horticulture sector

6.1 Introduction

Horticulture as an agricultural activity is concentrated in a number of countries. Italy and Spain have the largest number of horticultural farms (more than 20,000). Other countries with a large number of horticultural farms are France, the Netherlands and Portugal, with more than 10,000 farms. From a national perspective horticulture is of great importance in the Netherlands and Belgium. In both countries more than 10% of the farms belong to the horticultural sector. Luxemburg, Ireland, Sweden and Austria hardly have any professional horticulture in specialised farms. These countries will not be described in this chapter. Farm systems - both greenhouses and open air - as well as products (vegetables, flowers and flower bulbs) differ significantly between regions and countries.

6.2 Volatility of incomes

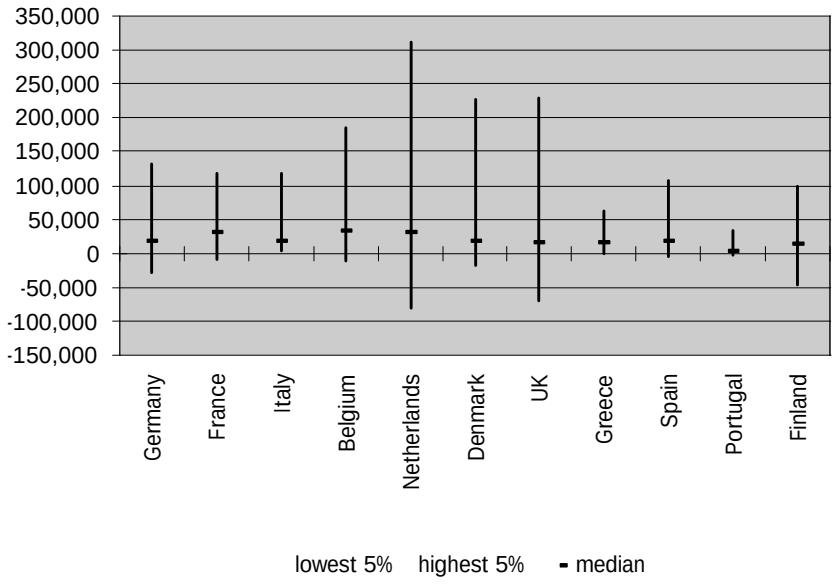
Table 6.1 gives an overview of the development of the nominal incomes in horticulture. Nominal incomes have increased substantially in all countries, except for Germany. Denmark as well as Spain and Portugal show a high increase. In absolute terms the highest incomes can be found in the countries where horticulture is an important activity, such as Belgium and the Netherlands. Greece, Portugal and Finland are countries with relatively low nominal incomes in horticulture.

Figure 6.1 and 6.2 also give an indication of the volatility of incomes. Figure 6.1 shows the development of the average income in the horticultural sector per year. Figure 6.2 puts this volatility in perspective of the size of the farm and the farm income level. The volatility is calculated as the deviation from the trend income development. The UK, the Netherlands and Denmark have the largest farm size and also a high level of income. The volatility of the income is however also high in these countries. Belgian horticulture achieves a good level of incomes with much smaller farms and also with much less volatile incomes.

Farms in Spain and Germany have an income development with only small deviations from the trend.

Despite the relatively high average incomes in most countries, there are still farms with financial difficulties, at least in specific years. Figure 6.3 shows the distribution of farm incomes in the different countries. The countries with the highest average horticultural incomes, Belgium and the Netherlands, also show the highest median values. The variety of incomes in the Netherlands is higher. The group with high incomes is larger and the group with low incomes is larger in the Netherlands compared to Belgium. In 2002, the Netherlands shows the widest range. The median value is much lower than the average income. This means that a small group of farms achieve high incomes, and a large group of farms have lower incomes. In 2002 in the Netherlands more than 5% of the farms have negative incomes of more than €75,000 and there are more than 5% of the farms with incomes higher than €310,000 euro. In the other important horticultural countries such as Italy and Spain the range is much more limited.

Figure 6.3 **Distribution of family farm income on specialist horticulture farms in 2002**



Source: FADN-CCE-DG Agri; adaptation by LEI.

6.3 Structural developments

Table 6.3 describes the development of the number of horticultural farms. The results differ widely across member states. A strong increase can be found in Spain, Greece and Germany. In all other countries the number of horticultural farms decreased; in France, Denmark and Portugal the decrease was at least 5% per year.

The average size of horticultural farms strongly increased in all countries during this period. Farms in the UK and Denmark in particular showed a strong increase. At the beginning of the nineties they were still smaller than in the Netherlands, but over the years the Danish farms grew bigger than their Dutch competitors. The average size of a horticultural farm in Denmark, the UK and the Netherlands passed 250 ESU. Horticulture farm sizes in other countries also show an increase.

Horticulture is a sector with traditionally a high labour input. In table 6.5 the average total labour input is described. In line with the increased size of farms the paid labour input increased in all countries. Compared to the strong increase in the size of farms, the increase in labour input is quite modest. Denmark and the UK have the highest share of paid labour: 80% of total labour. Italy, Greece and Portugal have a rate of paid labour of only 20%, making it still a family dominated business. In the Netherlands paid labour is about one third, with large differences between glasshouse and open air horticulture). In Belgium it is 40%, whereas in most other countries it is between 50 and 60%.

As an indicator, hectare is of limited importance in horticulture. A high amount of added value can be achieved on a relatively small area. Denmark and the UK have on average the highest number of hectares per farm. The number of hectares has grown strongly during the analysed period. Also farms in Germany, Italy, Spain, Belgium and the Netherlands increased the number of hectares. In Greece, France and Portugal this average figure decreased during the nineties (table 6.3).

Assets in horticulture increased strongly. The development runs parallel to development of the economic size. The increase in assets is stronger than the increase in hectares of farms; this increase in assets indicates (technological) investments in horticulture, e.g. in glasshouses or irrigation.
Regarding solvability table 6.3 shows strong differences between member countries: a much higher rate in the southern than in the northern countries

Table 6.3	Farm structure of specialised horticulture farms per country										
	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average size (ha)		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	9.1	1.1	169.5	4.1	4.45	1.3	4.1	3.2	305	3.6	39.9
France	8.8	-5.5	107.7	3.3	4.46	3.9	8.1	-0.8	210	4.1	41.8
Italy	26.0	-0.6	72.8	4.2	2.42	0.2	3.7	2.9	222	6.6	95.3
Belgium	3.8	-3.0	120.7	5.6	3.24	1.2	4.4	1.6	311	4.0	52.7
Netherlands	10.3	-2.4	286.6	6.7	6.19	1.8	8.5	3.3	1,392	8.0	46.7
Denmark	0.9	-5.6	294.6	9.6	6.96	4.5	11.5	3.8	955	9.9	40.1
UK	2.8	-1.6	320.3	13.9	8.02	4.2	14.1	1.7	599	5.5	75.2
Greece	11.4	1.3	19.6	1.9	2.02	0.4	2.6	-0.2	79	1.3	97,7
Spain	39.2	2.7	30.1	4.7	2.79	5.7	4.7	3.2	267	7.9	91.8
Portugal	8.0	-5.0	12.7	1.8	1.91	1.5	2.9	-5.8	38	1.1	97.8
Finland	2.4		63.0		3.53		5.6		213		44.6

Source: FADN-CCE-DG Agri; adaptation by LEI.

6.4 Situation in main horticulture regions

Table 6.4 presents the situation in the main horticultural regions. There are distinct differences in structure, level of income and income volatility. Some regions in the southern member countries have a higher volatility than in the northern countries, which in general have higher income levels.

Table 6.4 **Data for specialised horticulture farms in important horticulture regions (2002)**

Region	Number of farms	Esu	Ha	Family farm income (x 1,000)	Volatility income (%) 1990-2003	Assets (x 1,000)	Solvability
Andalucía	26,790	16	2	32.7	11	239	94
Netherlands	12,830	266	8	61.3	15	1,244	46
Sicilia	5,910	36	2	24.9	13	161	100
Liguria	5,600	31	1	25.7	6	169	100
Campania	3,810	53	1	44.7	24	94	100
Belgium	3,780	95	4	51.0	11	235	55
Provence-Alpes-Côte d'Azur	3,550	66	3	42.2	13	148	54
Lazio	2,840	44	2	32.1	57	87	99
Nordrhein-Westfalen	2,300	221	6	40.5	20	225	49
Veneto	1,880	53	3	35.2	37	256	100
East England	1,761	170	12	59.3	40	744	73
Baden-Wuerttemberg	1,570	128	3	36.3	17	344	42
Niedersachsen	1,060	224	2	17.3	28	280	8
Languedoc-Roussillon	1,000	90	7	47.7	23	206	42
Pays de la Loire	1,000	205	10	44.4	30	278	45
Denmark	1,000	244	9	54.9	34	891	43

Source: FADN-CCE-DG Agri; adaptation by LEI.

6.5 Within-farm volatility of farm incomes on horticultural farms

Table 6.4 also shows large differences in the volatility in the horticulture sector. The coefficient of variation in the horticulture sector is further specified in figure 6.4. It shows that there can be large differences within a country, and even within one specific type of farming (horticulture). This figure shows for instance that farm incomes in horticulture in the southern part of Spain are more volatile than in the northern part of this member state.

Figure 6.4 **Volatility of family farm incomes in horticulture per region**

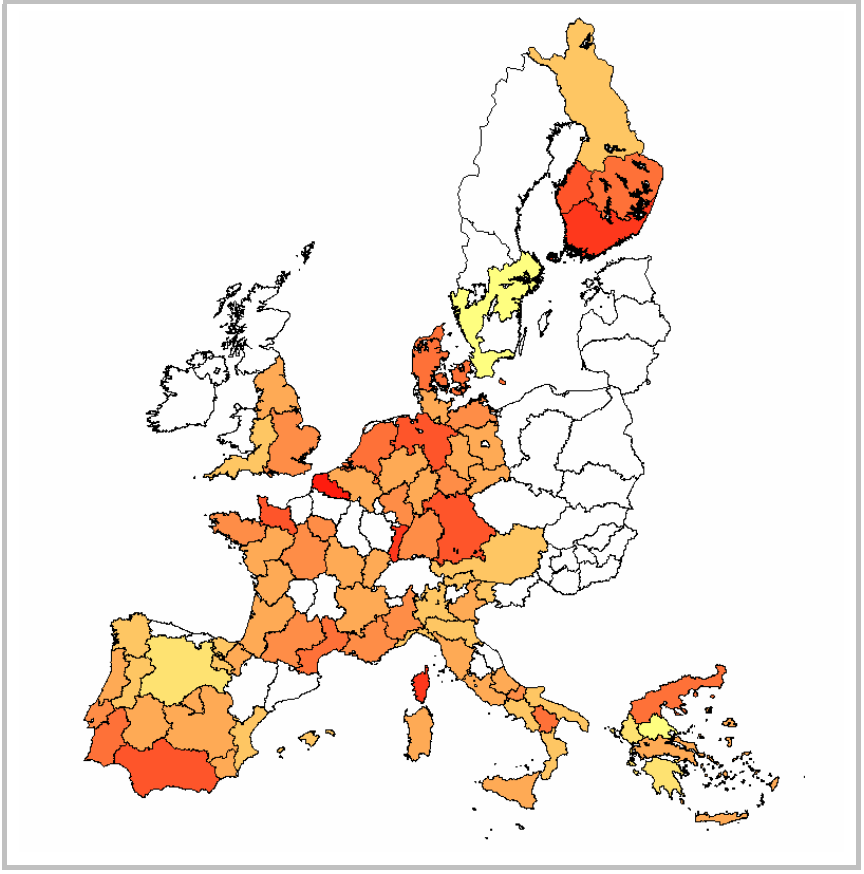


Figure 6.5 **Volatility of total output in horticulture per region**

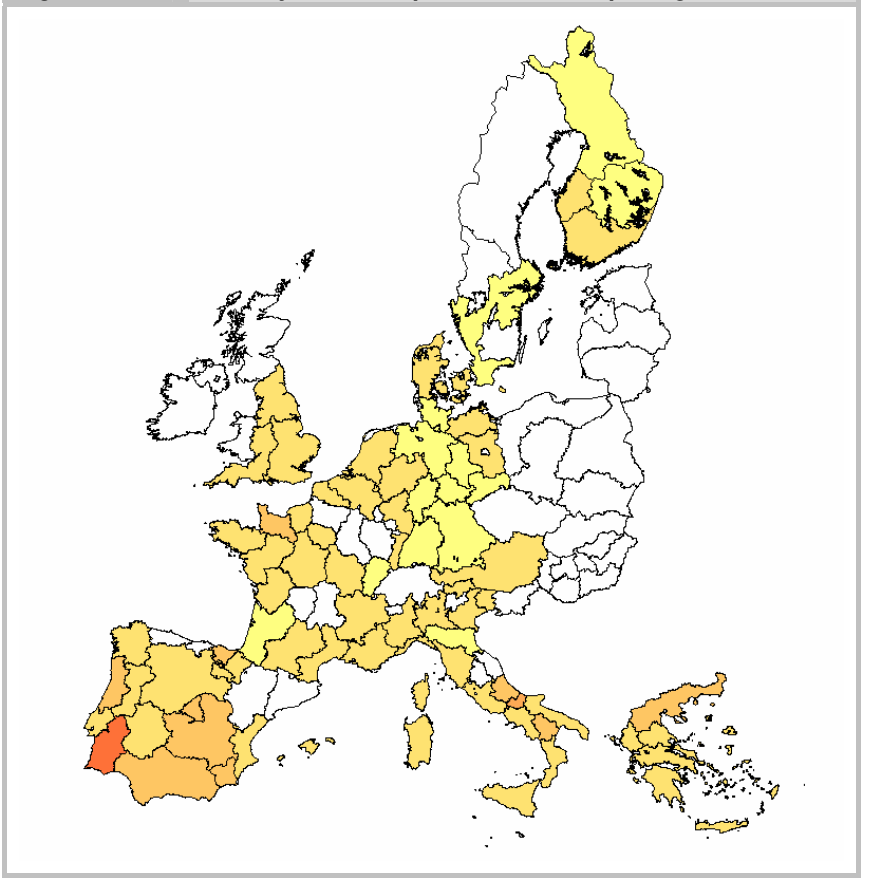


Figure 6.5 presents the coefficient of variation of total output for the different regions in Europe. The values reflect a combination of factors, such as: the climatic conditions, occurrence of diseases, the type crops per region, etcetera. The highest volatility of farm incomes can be found in Southern Europe. This reflects the fluctuating climatic circumstances in this part of Europe. Therefore figure 6.4 presents the volatility of total output. Comparison of both figure 6.4 and figure 6.5 reveals that the volatilities of farm income are much higher than those of production value. Farm income is much more volatile because it is a residual indicator.

6.6 Income crisis on horticultural farms

As illustrated in this paper there are large differences between farms. It is of interest to have a information on the robustness of farms; see section 5.8 for the method and distinction of farms in categories. The same approach as is used in that section on field crop farms is used here for horticulture farms. The results for the horticulture farms are displayed in figure 6.6. There are clear differences in the financial robustness of horticulture farms. Countries like Austria, Greece and Spain have a percentage of farms with a positive income after an external shock far above the European average. In countries like The Netherlands, Germany and Denmark and to a lesser extent France and the UK the percentage of farms with a positive income after the shock is much lower than the European average. These are also the countries with a relatively low level of solvability and a high level of volatility.

6.7 Conclusion

The results of specialised horticulture farms show an increase in incomes in the analysed period 1990-2003 in all member countries. In most countries the increase was even more than 4% per year. Average incomes of the growers in this sector were however fluctuating and the differences in incomes, at least in some countries (The Netherlands, Denmark and UK) are large. The robustness of farms to absorb an external shock differs strongly between countries. The volatility of incomes in the horticulture sector is substantial, the prices of products are not managed by the CAP.

7 Volatility of farm incomes in the wine sector

7.1 Introduction

The European Union is leading in the production of wine in the world, accounting for some 65% of production on 45% of the wine growing areas. In the EU, wine production is important in eight member states. In these countries some 200,000 farms are specialised in wine production. In Luxemburg and France more than 10% of the farms can be characterised as wine farms whereas in Italy and Portugal the number of wine farms is slightly lower. The analyses in this chapter show an interesting change in the structure of the sector as well as the incomes.

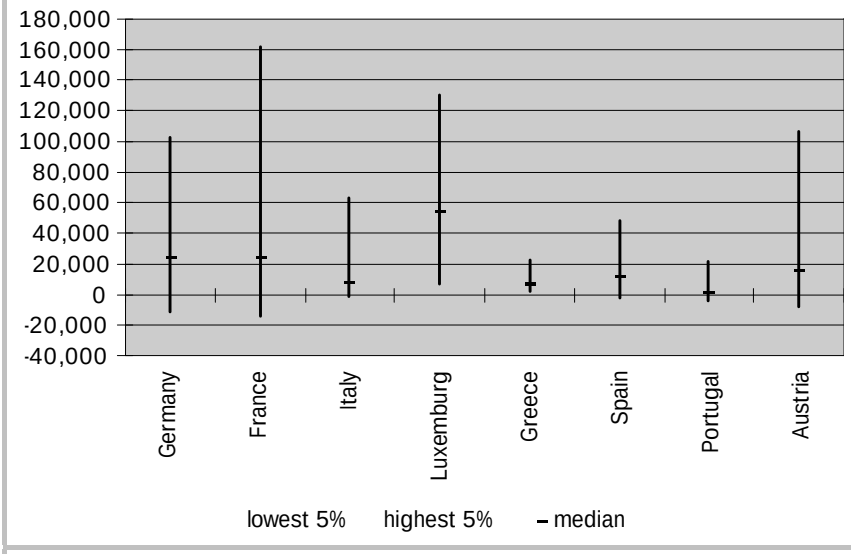
7.2 Volatility of incomes

The development of the average income of wine farms, in nominal terms, was positive in all member countries (table 7.1). Spain shows a very strong income growth. Farms in Spain were able to increase their revenues with hardly any increase in costs. Luxemburg and Germany also had a strong increase in revenues but were faced with increases in several cost components. In France and Germany the overhead costs increased substantially. In France and Luxemburg the labour costs increased strongly. Furthermore, the depreciation costs increased in Luxemburg. Income levels in Portugal and in Greece are still much lower than in other countries. Wine growers in France and Luxemburg have on average the highest incomes. The results of wine growers show a stable development in most countries (figure 7.1). The fluctuations of income levels differ between countries. France shows relatively high fluctuations with a low income level in 1993 and high income levels in 1998 and 1999. Also Luxemburg shows high income fluctuations. Income levels in Greece and Italy are more or less stable, though still with some regional differences as will be shown later.

Figure 7.2 shows a large dispersion of incomes within one country, especially in France. More than 50% of the farms received an income of less than €25,000 in 2002. The highest levels of income in France are however above €160,000. Specific data per region, which are presented later, reveal that

there are also large differences between regions. In Germany, France, Italy, Spain, Portugal and Austria at least 5% of the farms had negative incomes. Luxemburg has the highest median value: 50% of the farms realised farm incomes of more than €55,000 and almost no wine farms have negative incomes.

Figure 7.2 **Distribution of family farm income on specialised wine farms, 2002**



Source: FADN-CCE-DG Agri; adaptation by LEI.

7.3 Structural developments

The number of specialised wine producing farms increased somewhat in Greece and especially Spain. In all other countries the number of wine farms decreased, in particular Germany (table 7.3). The restructuring of the German wine sector may have stimulated the positive income development in this country (table 7.1). Italy still has the largest number of wine growers.

Table 7.3	Number of specialised wine farms per country per year (x 1,000)								
	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	8.9	-5.7	59.9	4.8	2.29	1.7	471	6.1	84,9
France	52.0	-0.2	102.4	7.0	2.60	1.7	451	3.7	70,2
Italy	85.1	-3.2	20.9	3.4	1.52	0.7	317	9.1	97,6
Luxemburg	0.2	-0.9	65.6	2.5	2.03	0.2	637	6.9	87,0
Greece	12.7	0.1	9.0	3.5	1.23	-1.9	75	1.7	100,0
Spain	42.4	3.8	18.8	10.2	1.44	4.1	176	3.8	98,3
Portugal	23.3	-4.4	9.8	4.2	1.56	0.9	63	2.4	98,4
Austria	1.9		15.8		2.24		352		81,0

Source: FADN-CCE-DG Agri; adaptation by LEI.

The size of the wine farms (in ESU) increased during this period (table 7.3). The growth in Spain and France is higher than in other countries. Farms in France are on average larger than in other countries. The small farms in Portugal and Greece stayed small with only a slight increase in the average farm size.

The trend in size in ESU is not reflected by a comparable growth in labour input (table 7.3). The strong growth in ESU per farm as well as the favourable income development in Spain has given opportunities for more labour input. In most other countries the number of workers on wine farms was fairly stable over the years, reflecting improved labour productivity. Wine producing farms in France, Luxemburg, Germany and Austria have on average more workers than in the South European countries. The paid labour costs are the highest in France and Luxemburg. Farms in Greece hardly use any paid labour.

Table 7.3 shows a large difference in invested capital (assets) per wine farm per country. Wine growers in Greece and Portugal still have few assets. Assets in other countries, however, increased significantly.

Solvability is quite high in the wine sector; although lowest for France, it is still 70 on average (table 7.3).

7.4 Development of prices and productivity

Wine is a somewhat heterogeneous product. This makes the development of prices hard to evaluate. With respect to the productivity side the tables in the previous section show that the growth of the value of assets is for most countries stronger than the growth in labour input or size. The assets per hectare and per labour input increased during the nineties. Spain is an exception, because there the growth of labour input was higher than the growth of assets.

7.5 Situation in main wine producing regions

Table 7.4 presents the data for the main wine producing regions. The differences in size, acreage and income level, are very large. The volatility rate in some regions is much higher than in others.

7.6 Within-farm volatility of farm incomes on wine farms

Table 7.4 also shows large differences in the volatility in the wine sector. The coefficient of variation in the wine sector is further specified in figure 7.3. It shows that there can be large differences within a country, and even within one specific type of farming, in this case wine growing. This figure shows for instance that farm incomes in wine growing in the south-west of France are more volatile than in the other regions of this member state.

Figure 7.4 presents the coefficient of variation of total output on wine farms for the different regions in Europe. The values reflect a combination of factors, such as: the climatic conditions, occurrence of diseases, the type of wine crops per region etcetera. Total output volatility in the southern regions of Spain is higher than in other regions of this member state. Comparison of both figure 7.3 and figure 7.4 reveals that the volatilities of farm income are much higher than those of production value. However, due to limited differences in the structure of farms, the regions with high output volatility also belong to the regions with high income volatility.

Table 7.4 Wine farms in important wine regions

Region	Number of farms	ESU	ha	Family farm income(x €1,000)	Income Volatility (%)	Assets (x €1,000)	Solvability
Languedoc-Roussillon	15040	46	21	19.6	23	241	66
Castilla-La Mancha	13970	11	22	13.6	68	216	100
Puglia	11580	11	6	6.1	24	245	100
Sicilia	10530	11	8	11.4	19	301	100
Veneto	8510	16	5	29.8	18	587	98
Piemonte	8050	14	6	19.5	18	212	100
Champagne-Ardenne	7990	122	7	99.5	29	788	79
Tras-os-Montes e da Beira Interior	7750	8	9	5.0	27	50	99
Aquitaine	7400	210	29	28.2	63	599	58
Sterea Ellas-Nissi Egaeou-Kriti	6890	9	4	7.1	22	83	100
Rheinland-Pfalz	6870	55	9	31.3	10	410	84
Provence-Alpes-Cote d Azur	5350	64	21	40.7	12	331	75
Abruzzi	4870	13	5	18.3	18	199	99
Rhone-Alpes	4750	67	15	31.6	20	283	65
Emilia-Romagna	4460	15	7	10.0	26	366	98
Poitou-Charentes	3460	80	42	23.8	35	373	75
Bourgogne	3220	147	16	73.1	44	503	62
Rioja	2780	24	14	12.4	92	260	100
Alsace	2490	100	8	54.1	13	294	60
Toscana	1910	42	21	73.4	29	1206	96

Source: FADN-CCE-DG Agri; adaptation by LEI.

Figure 7.3 **Volatility of farm income of wine farms per region**

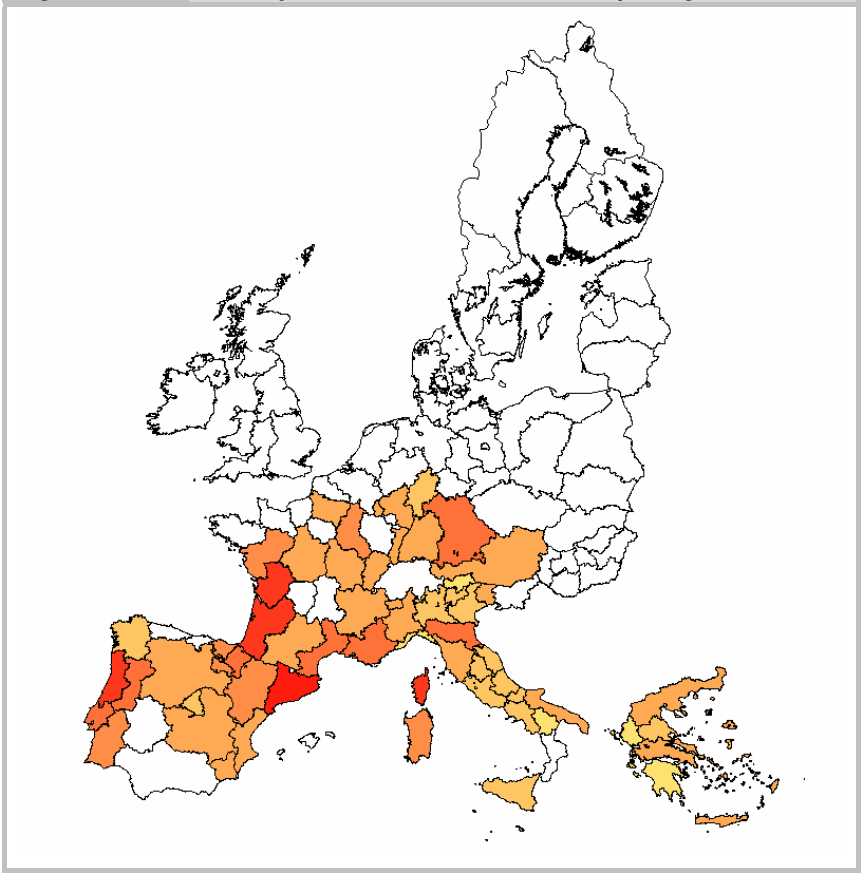
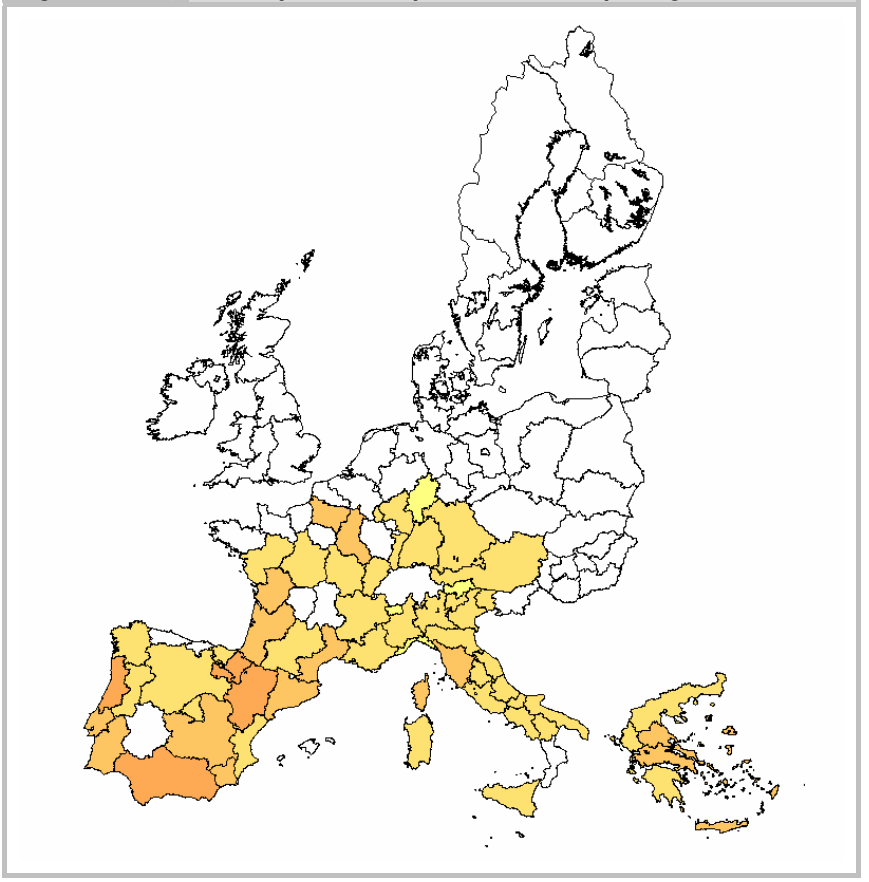


Figure 7.4 **Volatility of total output of wine farms per region**



7.7 Income crisis on specialised wine farms

As illustrated earlier, there are large differences between farms. It is of interest to have information on the robustness of farms; see section 5.8 for the method and distinction of farms in categories. The same approach as is used in that section on field crop farms is used here for wine farms.

The results for the wine farms are displayed in figure 7.5 (see appendix) There are differences in the financial robustness of farms. The number of farms with a positive income after an external shock is higher than the European average in countries such as Austria, Greece and Spain. In countries like France and Germany the figure is lower than the European average.

Compared to other types of farming, it clearly shows that wine farms are quite robust. A large part of farms can still achieve positive income levels when an external shock reduces the output by 30%. This is in line with the high solvability of these farms and the limited amount of paid labour.

7.8 Conclusion specialised wine farms

The results of specialised wine farms show an increase in incomes in the period under analysis, 1990-2003, in all wine producing member countries. Average incomes of wine farmers were however fluctuating and the differences in incomes, at least in some countries (especially France and Luxemburg) are large. The wine producing farms are very robust in absorbing external shocks. Most farms in all member states would still have a positive income if an external crisis reduced the output by 30%.

8 Volatility of farm incomes in the permanent crops sector

8.1 Introduction

In this section the volatility of incomes of farms specialised in other permanent crops is presented. The developments in the wine sector are described in the previous section. Other permanent crops deal mainly with the production of fruits and olives. In the remainder of this chapter we will refer to this group as permanent crops. After some data on the permanent crops in general, more attention will be paid to these specialisations. The production of nursery trees is included in the general data on permanent crops.

The production of permanent crops is for a large part concentrated in a few countries. In Greece, Italy, Portugal and Spain between 20 and 40% of the farms are specialised in these crops. Farms in these countries produce olives and fruits - citrus as well as apples and pears. In the other countries the number of farms specialised in these crops is less than 5%. The production of apples and pears in France, Germany and to some extent also in Belgium, the Netherlands and Austria is worth taking into account. In other countries the number of specialised producers of these crops is too low and will not be described in the analyses.

8.2 Volatility of incomes

Growers in Spain, Denmark and the UK strongly improved their incomes during the period under analysis and are confronted with strong fluctuations in their incomes (table 8.1). In most of the countries the incomes decreased during the early nineties and then showed a gradual increase (figure 8.1). Incomes in Portugal and Greece remained at low levels but increased slowly. Absolute incomes in the northern countries are in general at a higher level.

8.3 Volatility of income of fruit farms

Fruit farms can especially be found in Italy and Spain. Greece and Portugal also have a significant number of fruit growers. The number in Belgium, the Netherlands, Denmark and the UK is limited. This will be further described in the section about the structural developments of fruit farms. Fluctuations in the presented data can be caused by the limited number of observations for these countries. Ireland, Luxemburg, Finland and Sweden are not presented at all, because of the low number of farms.

Specialised fruit farms in most countries are confronted with significant fluctuations in incomes, as is shown in table 8.3 and figure 8.2. Spanish growers were however successful with a continuous improvement.

Growers in Belgium show the highest absolute incomes, some with extreme values (see figure 8.3). Growers in the Netherlands and especially the UK had strong fluctuations in incomes, caused by changes in prices and yields, for instance due to frost damage. France and Germany have fruit farms with similar sizes but with less fluctuations from year to year. Compared to other types of farming the fruit farms in Denmark are small. Fruit farming in Spain and Greece show more stable incomes than those in Portugal and Italy.

8.4 Structural development of fruit farms

Fruit production is mainly concentrated in Italy and Spain (table 8.4). These countries have 70 and 116 thousand farms specialised in fruit growing. Greece and Portugal also have a substantial number of growers. Spain shows an increasing population of specialised fruit growers, whereas in Denmark and the UK, the number of fruit growers is very limited and decreasing. The number of fruit growers in Belgium and the Netherlands is low but rather stable.

The average size of the farms in ESU increased or remained the same in all countries (table 8.4). A strong growth can be observed in France and Germany. However, in the Mediterranean countries the fruit sector is characterised by a large number of farms that are on average much smaller than in the north.

Table 8.4	Data on farm structure of specialised fruit farms per country								
	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average total assets (x €1,000)		Solv-ability
	2003	% trend	2003	% trend	2003	%-trend	2003	% trend	2003
Germany	3,3	3,7	113,5	7,8	3,14	2,3	567	7,1	78,6
France	7,3	-1,6	96,8	6,1	4,82	3,0	260	1,3	55,3
Italy	70,7	-5,5	21,1	2,3	1,26	-1,3	217	6,2	99,3
Belgium	1,2	1,7	136,4	4,5	3,96	1,8	514	4,7	76,1
Netherlands	1,5	-1,7	89,1	2,1	3,09	1,4	837	6,2	64,7
Denmark	0,3	-5,8	49,8	5,5	1,05	-1,2	328	8,2	52,4
UK	0,5	-3,6	128,2	6,1	6,10	0,8	919	4,7	84,4
Greece	32,1	-2,8	7,0	-0,8	1,12	-3,2	73	1,6	99,8
Spain	116,4	3,1	12,4	4,0	1,15	2,6	122	-0,3	98,4
Portugal	11,7	-4,6	8,9	3,1	1,12	-0,6	70	1,9	98,5
Austria	1,8	.	40,2	.	2,47	.	331	.	90,8
Source: FADN-CCE-DG Agri; adaptation by LEI.									

The differences between the countries in the average size of the fruit farms are also reflected in the number of workers. In the main fruit producing countries the total labour input per farm is just above 1. Greece shows strong fluctuations in the estimations of the total labour input. In Italy, Denmark and Portugal the labour input is decreasing. In Spain, Germany and France the total labour input increased during the nineties. The UK has a high labour input per farm. A large part of this labour is hired labour, which leads to substantial labour costs. Other countries with a large share of hired labour are France, Belgium and the Netherlands. In Greece, Spain and Portugal most of the labour is unpaid family labour.

Table 8.4 also shows a strong increase of assets (investments) in Italy, Germany and Denmark. The solvability remained almost the same in all counties, except for Denmark, which showed a slow increase.

8.5 Development of prices and productivity

Tables 8.5 and 8.6 give some information on the development of prices in the fruit sector, in this case for apples and pears. Looking at the trend, Spanish

prices decreased. Also the prices of oranges fluctuated. Fruits are heterogeneous products. Price changes consist of real price changes and (quality) changes in the produced products.

8.6 Main fruit producing regions

Table 8.7 provides information on some main fruit producing regions. Except for the Netherlands and some other regions, the volatility of incomes is rather low in this type of farming. Solvability at the same time is high for most of these regions

The table underscores the large differences in average farm size, acreages as well as income level and income volatility between the main fruit producing regions in the EU.

8.7 Volatility of income of olive farms

Production of olives is only relevant in the southern countries Spain, Portugal, Italy and Greece. France has some specialised olive farms, but too less to report on them.

Incomes, in nominal terms, on specialised olive farms developed in a positive direction in Italy. Average incomes in Greece and Spain also increased but at a slower rate (table 8.8 and figure 8.4). Portugal, with a much smaller population of olive producing farms, shows a negative income development, at a very low level. Olive farms in Spain achieved the highest income levels but also showed stronger fluctuations between years. The upward fluctuations seem to be stronger than the downward fluctuations, which is a good thing for the risk of the farms.

8.8 Structural developments of olive farms

Table 8.9 shows the number of specialised olive farms in 2003 as well as the trend estimated according to FADN data. Some large changes in 2000 were caused by the use of new data from the farm structure survey and new SGM (ESU). These changes had a big impact on the number of farms that are characterised as olive farms. Even without these changes the conclusion can be drawn that the number of olive farms has grown in Greece and Spain. This trend was

Table 8.7 Main fruit producing regions (2002)

Region	Number of farms	ESU	ha	Family farm Income (x €1,000)	Income volatility(%) 1990-2003	Assets (x €1,000)	Solva-bility	Price apples pears (€/100kg
Comunidad Valenciana	71740	8	5	9.3	11	131	100	29
Makedonia-Thraki	17860	8	4	6.7	11	62	100	32
Sicilia	14730	14	5	11.7	14	175	100	36
Ipiros-Peloponnissos-Nissi Ioniou	11240	7	2	13.1	17	60	99	61
Campania	10650	12	4	13.9	17	194	100	54
Emilia-Romagna	10380	26	7	13.7	28	337	100	35
Aragon	7140	11	10	17.1	32	84	95	30
Calabria	5960	16	5	13.6	19	218	100	.
Cataluna	5870	26	12	16.7	43	175	89	27
Bolzano-Bozen	5170	35	4	25.7	36	325	97	34
Piemonte	4990	16	6	19.0	20	270	100	32
Trento	4770	26	3	24.2	28	850	98	35
Ribatejo e Oeste	4110	23	8	5.8	44	95	100	107
Veneto	2770	35	8	24.2	34	615	100	29
Netherlands	1860	89	12	22.3	55	758	66	44
Provence-Alpes-Cote d Azur	1765	88	22	20.4	45	145	48	30
Rhone-Alpes	1724	93	29	23.3	30	239	65	45
Languedoc-Roussillon	1553	85	15	23.5	43	166	50	36

Source: FADN-CCE-DG Agri; adaptation by LEI.

already visible before the year 2000. In the other countries it is more difficult to recognise a trend.

Table 8.9	Data on farm structure of specialised olive farms per country per year					
	Number of farms (x 1,000)		Average size (ESU)		Average size (ha)	
	2003	% trend	2003	% trend	2003	% trend
Italy	80,3	-1,7	12,8	4,3	7,4	1,2
Greece	116,0	4,3	5,4	-1,4	4,0	-2,3
Spain	90,0	12,7	18,4	7,1	16,3	-4,1
Portugal	3,5	-2,1	10,6	7,5	33,5	-0,3
Source: FADN-CCE-DG Agri; adaptation by LEI.						

The average size of the farms (in ESU) increased in Spain and Portugal (table 8.11). Farms in Greece became on average smaller in size. Spain has on average the largest olive farms. Portugal has small-sized olive farms with an average of 10 ESU.

Despite the growing size in ESU in Spain and Portugal the labour input decreased. The changes in the farm structure survey and the SGM also seem to affect the estimates of labour input. Also the estimated total labour input in Italy and Greece decreased. The share of paid labour is the highest in Spain, with its larger farms. At the end of the nineties the share of paid labour was around 50%. In the other countries this share is only 15%.

The Iberian countries have larger farms, measured in hectares (table 8.11). Given the economic size of farms in Portugal and the output on the farms, olive farms in Portugal are extremely extensive. Solvability of olive farms is close to 100 in all countries. Total assets are higher in Italy and Spain (some €150,000) than in Greece and Portugal, €60,000 on average per farm in both countries.

8.9 Main olive producing regions

Table 8.10 shows a quite large difference in average income results for the main olive producing regions. Also the volatility differs strongly between regions. Cataluna shows a volatility of 82 compared to 22 in Andalucía. The solvability is high in all regions, close to 100. The prices of oil in some Italian regions are much higher.

Table 8.10	Results of main olive producing regions (2002)								
Region	Number of farms	Size		Family farm income (x €1,000)	Volatility income (%) 1990-2003	Assets (x €1,000)	Solvability	Olive oil price	Olives yield per ha
		ESU	ha						
Andalucía	129,230	15	11	14.5	22	174	99	.	.
Ipiros-Pelop.-Nissi Ioniou	829,70	8	4	18.5	29	41	100	211	814
Sterea Ellas-Nissi Egaeou-Kriti	583,90	5	4	10.0	20	95	100	219	1180
Puglia	18,800	17	9	9.1	33	253	100	229	634
Calabria	18,020	12	6	11.2	30	147	100	280	983
Castilla-La Mancha	8,180	6	13	5.6	.	56	100	.	.
Sicilia	7,400	9	6	7.3	42	174	100	371	562
Extremadura	6,470	6	13	8.0	.	79	100	.	.
Cataluna	5,580	8	13	9.7	83	204	100	.	.
Toscana	4,600	11	7	11.1	65	231	93	.	.
Campania	4,340	8	5	8.0	35	219	100	332	707
Lazio	3,930	9	5	8.0	51	144	100	519	427
Tras-os-Montes e da Beira Interior	3,013	7	31	3.0	49	53	100	280	95
Abruzzi	2,960	8	4	7.7	69	129	100	582	741

8.10 Within-farm volatility of farm incomes on permanent crop farms

Table 8.7 and table 8.10 show differences in the volatility of results of fruit farms and olive farms. The coefficient of variation in the permanent crop sector is further specified in figure 8.5. It shows that there are large differences within a country. This figure shows for instance that farm incomes on permanent crop farms in the southern part of Germany are more volatile than in the other regions of this member state.

Figure 8.6 presents the coefficient of variation of total output on wine farms for the different regions in Europe. The values reflect a combination of factors, such as climatic conditions, occurrence of diseases, the type of permanent crops per region etc. The volatility of total output in the southern regions of the UK is higher than in other regions of this member state. Comparison of both figures 8.5 and 8.6 reveals that the volatilities of farm income are much higher than those of production value. Farm income is much more volatile because it is a residual indicator.

Figure 8.5	Volatility of farm income of permanent crop farms per region

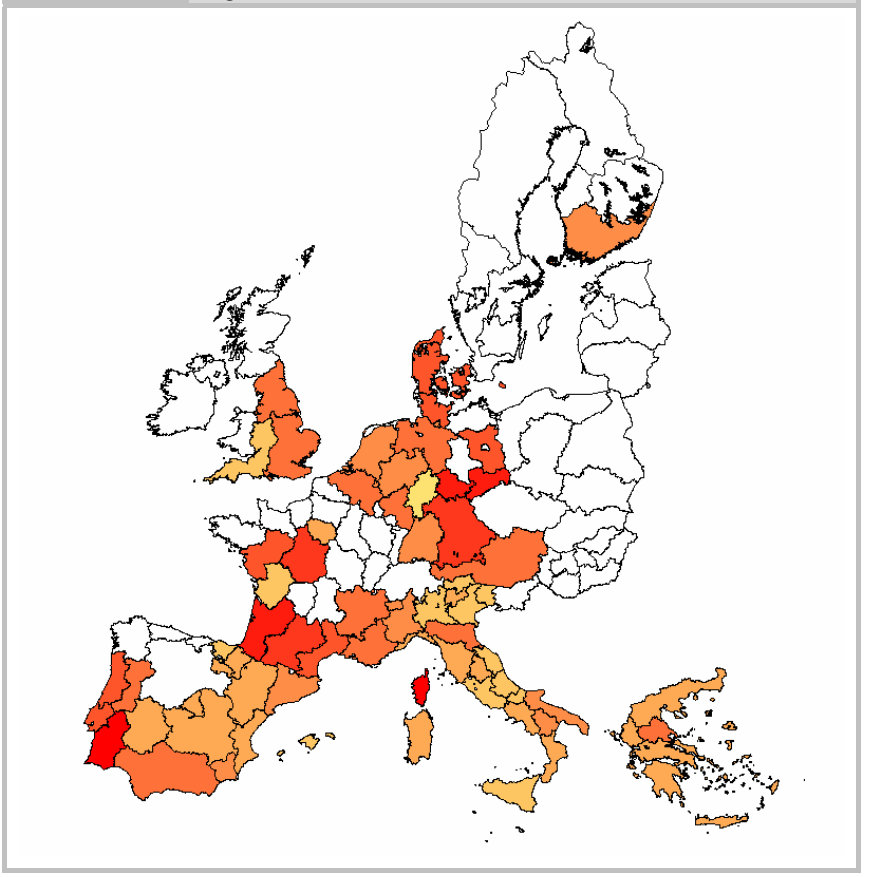
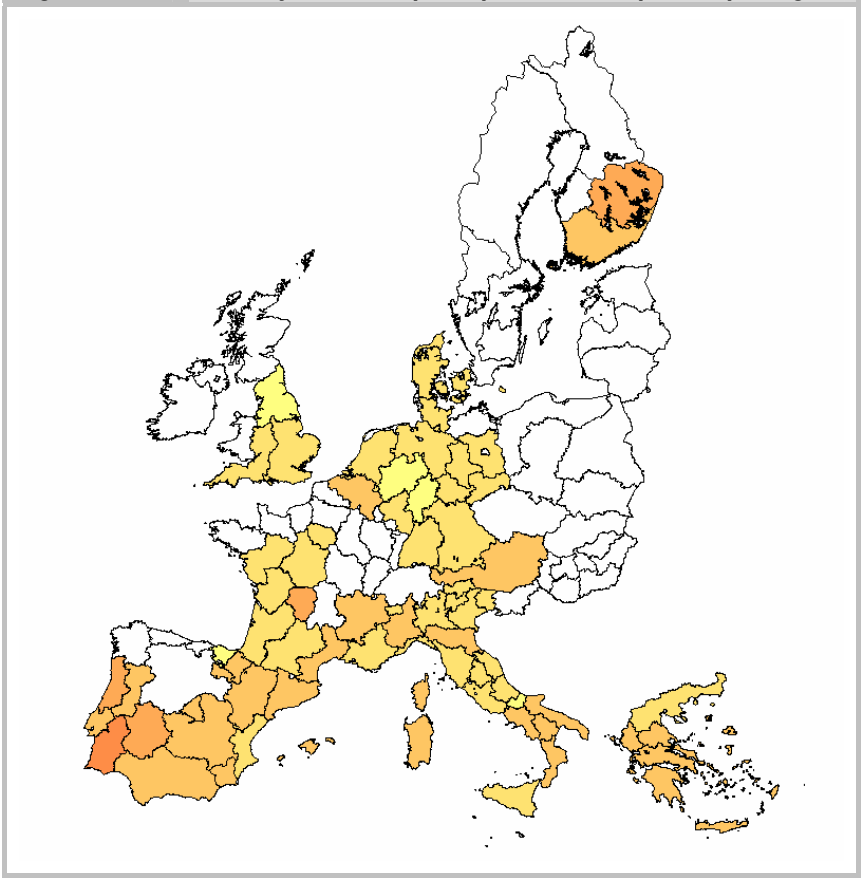


Figure 8.6 **Volatility of total output of permanent crop farms per region**



8.11 Income crisis on permanent crop farms

As illustrated in this report there are large differences between farms. It is of interest to have information on the robustness of farms; see section 5.8 for the method and distinction of farms in categories. The same approach as is used in that section on field crop farms is used here for permanent crop farms.

The results for the permanent crop farms are displayed in figure 8.7. There are differences in the financial robustness of farms. The number of permanent crop farms with a positive income after an external shock in countries such as Finland, Greece and Spain is higher than the European average. In countries like

Denmark, the UK, the Netherlands, France and Germany this figure is lower than the European average.

8.12 Conclusion permanent crop farms

The results of permanent crop farms show an increase in incomes in the period under analysis, 1990-2003, in all member countries. In most countries the improvement is strong, 3% or more per year. For fruit farms, a specific part of the permanent crop farms, the same can more or less be concluded. For olive oil farms the results for Portugal, with a negative income trend, are an exception to this.

The volatility of incomes in the fruit sector is limited with the exception of Belgium, the Neherlands and the UK. The level of incomes in the olive sector is low. Also the fluctuations are limited, and with more upward instead of downward exceptions, which is positive for the farmers.

Farms in Greece and Spain are extremely robust in case of an external event. Almost all farms still achieve a positive income after an external crisis. Farms in Denmark and the UK have serious problems in dealing with an external crisis.

9 Volatility of farm incomes in the Dairy sector

9.1 Introduction

In this section the results of farms specialised in dairy production are presented. It is important to recognise that the number of dairy farms in the total farm population (in FADN) per member country is very different. In general, dairy farms are most important in the northern countries, including Germany, Austria and Luxemburg. In Germany, the Netherlands, Austria and Sweden this is about one third of the farms. In Luxemburg it is even more than 50%. In the southern countries only a small percentage of farms (less than 10%, in Greece even less than 1%) is specialised in dairy. In the UK, Belgium, Denmark and France the share of specialised dairy farms is around 20%.

9.2 Volatility of incomes

Spain, Portugal and Italy show a favorable income development for dairy farmers (table 9.1 and figure 9.1), with a fast growth of the average herd size in the period 1990-2003 (table 9.2). The absolute income level in Italy has in recent years been much higher than in countries with a comparable average herd size (Germany, France, Ireland and Sweden). A main reason for the high income level in Italy is the high price of milk in Italy, which is some 20% higher than in all other countries (table 9.3). In fact this situation did not change during the period under analysis. In all countries nominal milk prices (in euros) were more or less stable with changes of less than 10% over the years. Denmark and Greece show a fall in incomes in nominal terms.

9.3 Structural developments

During the analysed period the number of specialised dairy farms in all member countries fell rapidly (table 9.2). In most countries the number of dairy farms at the end of this period was around 40 to 50% lower than at the beginning of the nineties. The reduction was especially strong in Spain, where the number of

commercial farms was reduced to one third. Given the constant dairy quota per member country this means a growth in production of milk per farm, although some farms just became 'statistically' less specialised due to a reduced number of dairy cows with increased milk production per cow and unchanged land surface or increased beef production. This growth in milk production per farm was realised by a growing herd size as well as a growing yield per cow in most member countries.

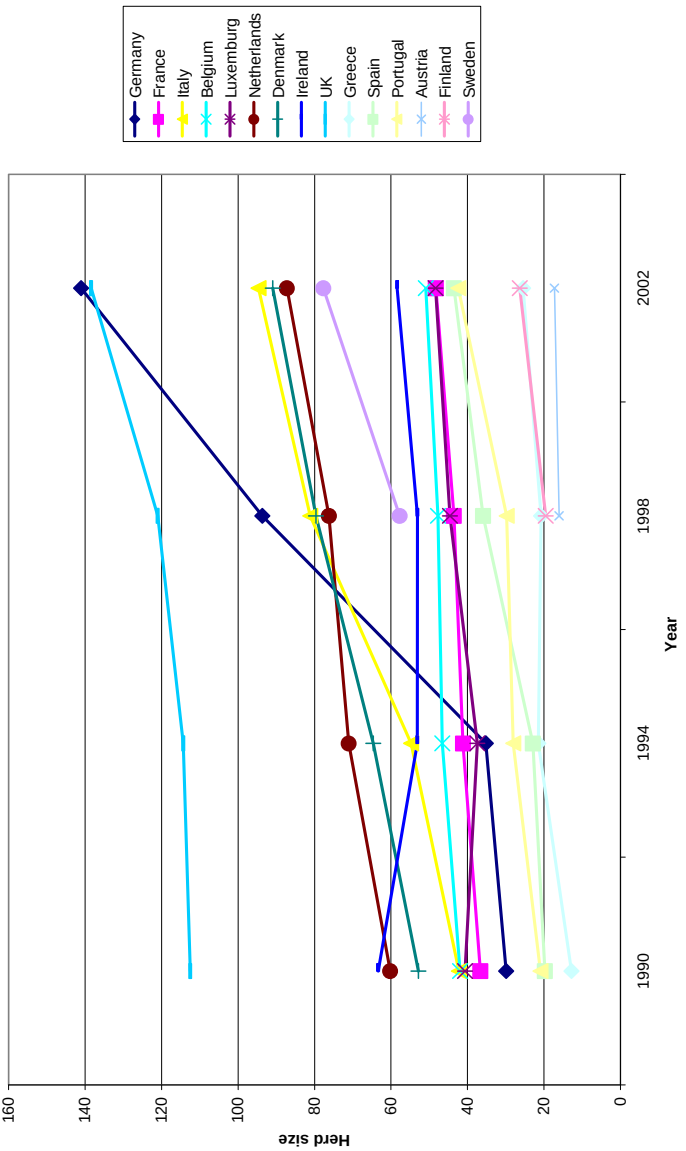
Table 9.2 Data on farm structure of specialised dairy farms per country

	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average number of cows		Average total assets (x €1,000)	
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003	% trend
Germany	73.6	-5.3	69.9	5.6	1.76	0.9	42.4	4.4	563	7,4
France	63.7	-4.9	58.9	7.0	1.70	0.7	41.2	2.6	198	4,3
Italy	40.8	-3.9	82.6	14.5	2.18	0.8	50.6	7.5	737	14,4
Belgium	8.0	-6.2	75.9	3.8	1.57	-0.2	49.1	2.6	270	4,7
Luxemburg	0.7	-5.7	69.6	3.1	1.74	0.0	41.9	1.4	821	6,4
Netherlands	21.7	-3.7	127.1	5.6	1.69	0.6	72.7	3.4	2204	14,1
Denmark	6.3	-6.8	134.8	6.8	1.87	1.1	85.1	6.2	1292	15,8
Ireland	23.4	-4.6	49.8	4.4	1.54	0.1	46.5	3.1	667	12,4
UK	21.6	-4.0	112.7	4.1	2.18	-0.8	95.0	2.5	791	5,0
Greece	1.5	-1.8	25.0	12.3	1.78	-1.8	30.5	2.1	109	6,8
Spain	29.4	-8.5	27.0	7.4	1.52	0.7	30.6	8.8	255	9,9
Portugal	11.4	-5.8	24.5	11.5	1.70	-0.2	23.7	8.0	66	2,2
Austria	29.4		23.0		1.67		14.5		319	
Finland	16.2		42.4		2.08		21.1		253	
Sweden	9.2		91.5		2.03		44.5		436	

Source: FADN-CCE-DG Agri; adaptation by LEI.

The average farm size in dairy farming per member country is very different (table 9.2). In three member countries (UK, the Netherlands and Denmark) the average size of dairy farm is above 100 ESU. Greece, Portugal, Spain and Austria, however, still have around 25 ESU. In most member countries the size doubled during the analysed period. This means a fast structural development. The main factor in this is the increase of the herd size per farm (table 9.6). Figure 9.3 shows the Lund indicator for herd size. This indicator gives the size of

Figure 9.3 **Lund indicator for herd size**



the herd for which the statement is valid that 50% of the cows belong to herds smaller than this size and 50% to larger herds.

The number of workers per dairy farm remained the same in most member countries (table 9.2). Denmark is an exception with a small increase in labour input. In the UK, with more than 2 working units per farm, it is obvious that the number of salaried workers fell. Labour input in most countries is for a large part provided for by family workers. The amount of paid labour is the highest in the UK, Denmark and Sweden. Farms in Greece, Spain, Portugal and Belgium hardly use any paid labour.

Herd size per farm increased in all countries (table 9.2). Italy, Spain, Portugal and Denmark show the fastest increase, with on average more than 6% per year. This is an important reason for the favourable income development in Italy and Spain. The effect of the re-unification in Germany was not as large as in the cereals sector. This growth combined with the high increase of yields per cow in Germany and Italy (table 9.3) has lead to an improvement of incomes.

Table 9.2 also provides information on the total assets (value of land, buildings and machinery per dairy farm). The table shows that the Netherlands has by far the highest amounts per farm, much higher than in the UK, Denmark, Italy and Luxemburg. In most countries, except Portugal, the assets increased strongly, especially in Italy, The Netherlands, Luxemburg and Denmark. A high level of investments and higher prices of land are the main reasons for this growth. There are also large differences in investments in intangible assets due to differences in tradability of quota in member states. In some countries, such as the Netherlands, quota can be traded more or less freely, leading to high quota prices, a high net worth of the farm and - for investing farms - higher interest costs.

9.4 Development of prices and productivity

Yields in kg per cow are relatively high - 7,000 kg or more - in Scandinavia and the Netherlands and Luxemburg. The annual gain in productivity per cow was high in Portugal (3%) as well as in Spain, Germany, Denmark, Luxemburg and Italy (more than 2%). An exception is Greece, where yields per cow only slowly increased (table 9.3).

Prices of milk, in nominal terms, only showed minor fluctuations during the analysed period. Despite these low fluctuations, there is a large difference in prices between member countries. Italy has by far the highest level, around 40 eurocents per kg. The Italian prices showed a slight decrease. Prices in Ireland,

the UK and Portugal were in most years lower than 30 eurocent. Prices in France, Germany, Belgium, the Netherlands and Denmark are comparable, in most years just above 30 eurocent. The favourable situation in Italy is mainly due to the extra revenues from high premium cheese making - sometimes on the farm. Italian farmers also benefit from producing in a net-importing country, where competitors face more transportation costs to the market.

Table 9.3 **Yield per cow and average price of milk on specialised dairy farms**

	Yield (100 kg per cow)		Price (euros per 100 liters)	
	2003	**% trend**	**2003**	**% trend**
Germany	66.2	2.1	29.90	0.1
France	59.5	1.2	31.80	1.2
Italy	65.2	2.8	38.90	-0.5
Belgium	59.2	1.8	30.00	0.8
Luxemburg	70.4	2.6	32.00	-0.3
Netherlands	73.7	1.0	32.50	0.6
Denmark	76.8	2.0	33.20	0.0
Ireland	52.4	1.5	26.90	0.9
UK	68.2	1.8	25.80	0.5
Greece	47.2	0.5	34.40	0.4
Spain	57.0	2.9	30.50	1.1
Portugal	60.4	3.0	28.70	-0.4
Austria	59.5		29.00	
Finland	80.2		35.90	
Sweden	79.0		34.30	

Source: FADN-CCE-DG Agri; adaptation by LEI.

9.5 Main dairy regions

Table 9.4 presents data for the main dairy regions in Europe. Compared to other sectors the average family farm income is positive and the volatility of incomes is rather low.

Table 9.4 Specialised dairy farms in important dairy regions, 2002

Region	Number of farms	ESU	ha	Family farm Income (x €1,000)	Volatility income (%)	Assets (x €1,000)	Solva-bility	Milk price	Kg milk per cow
Bayern	34,330	36	33	22.1	15	556	89	32	5,986
Ireland	27,600	47	45	29.6	9	820	96	28	5,061
Nederland	26,330	123	42	33.8	14	1946	74	34	7,358
Galicia	22,290	12	12	17.3	16	225	97	30	4,959
Bretagne	15,570	61	56	29.8	13	180	36	31	6,519
Niedersachsen	11,500	66	55	23.4	13	477	76	29	6,915
Basse-Normandie	10,080	59	60	19.1	20	174	36	33	5,557
Pays de la Loire	9,050	59	62	29.4	18	153	41	32	6,377
Lombardia	8,640	103	38	78.3	24	1168	98	38	7,008
Denmark	8,550	108	72	14.5	27	937	33	34	7,292
Belgium	8,110	70	41	34.3	8	249	57	30	5,844
Rhone-Alpes	7,880	42	55	24.1	9	188	61	36	5,547
Baden-Wuerttemberg	7,410	41	42	22.1	15	501	83	32	5,879
West-England	7,310	112	81	51.6	19	749	76	27	6,788
Emilia-Romagna	6,400	127	35	82.4	27	1262	98	48	6,623
Nordrhein-Westfalen	6,070	62	49	31.2	13	489	78	32	6,993
Schleswig-Holstein	5,520	73	65	39.6	9	680	81	29	6,875
North-England	5,200	104	79	36.1	21	719	82	27	6,796
Northern Ireland	4,820	63	58	16.4	25	608	96	25	5,973
Wales	3,260	98	83	51.4	18	716	82	26	6,500
East-England	1,750	144	112	37.4	30	901	81	27	7,082

Source: FADN-CCE-DG Agri; adaptation by LEI.

9.6 Within-farm volatility of farm incomes on specialised dairy farms

Table 9.4 also shows differences in the volatility in the dairy sector. The coefficient of variation in the dairy sector is further specified in figure 9.4. It shows that there can be differences within a country. This figure shows for instance that farm incomes on dairy farms in the northern part of Spain are more volatile than in the other regions of this member state.

Figure 9.5 presents the coefficient of variation of total output on dairy farms for the different regions in Europe. The values reflect a combination of factors, such as the climatic conditions, occurrence of diseases, the relation between the output of milk and meat per region etc. The volatility of total output in the northern regions of the UK is higher than in other regions of this member state. The volatility of total output is very low for all regions within Europe, except for Spain and the northern areas in Europe.

Comparison of both figure 9.4 and figure 9.5 reveals that the volatilities of farm income are higher than those of production value but there is a clear correlation. Areas with a higher volatility of output also belong to the countries with higher income volatility.

Figure 9.4 Volatility of farm income of dairy farms per region

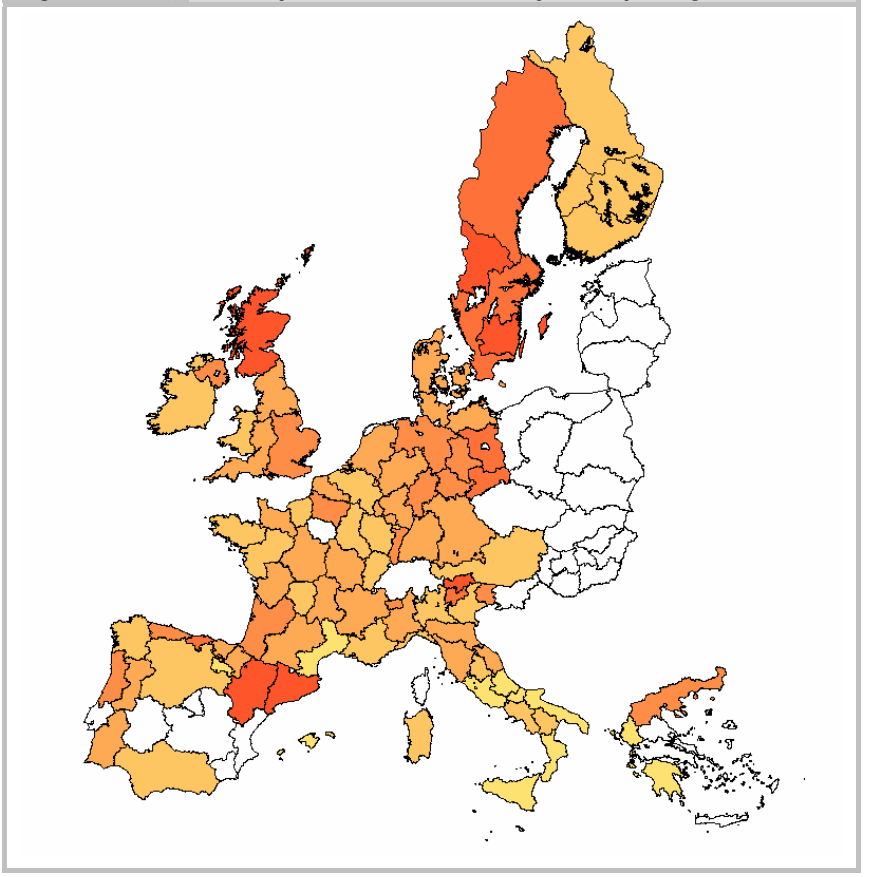
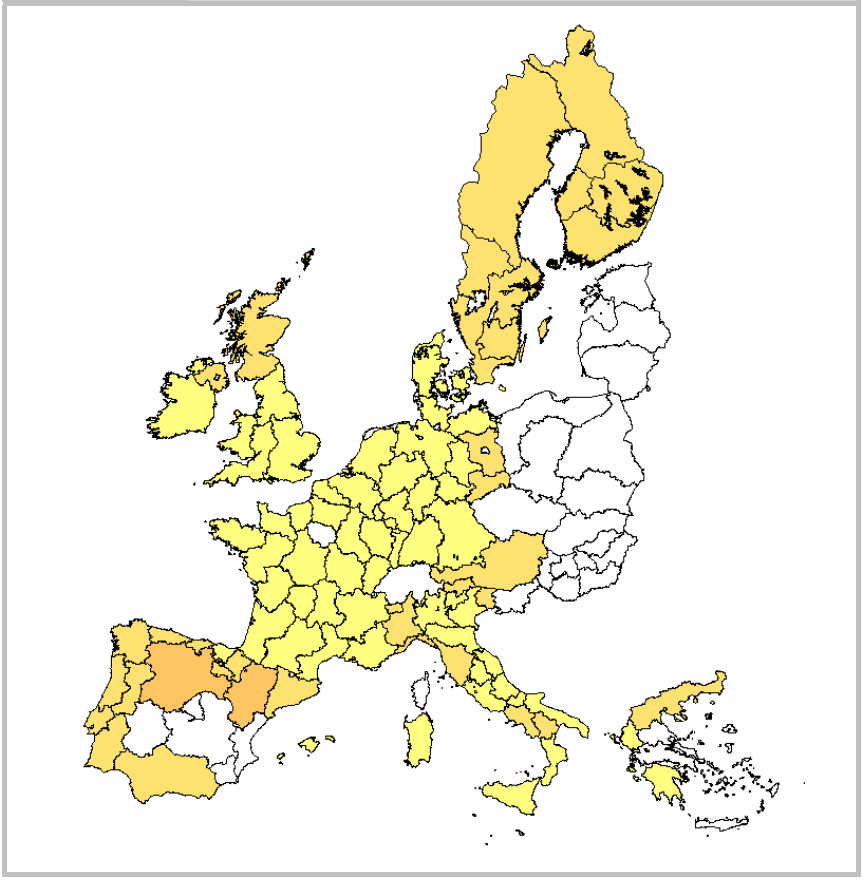


Figure 9.5	Volatility of total output of dairy farms per dairy farms per region



9.7 Income crisis on specialised dairy farms

As illustrated in this report there are large differences between farms. It is of interest to have information on the robustness of farms; see section 5.8 for the method and distinction of farms in categories. The same approach as is used in that section on field crop farms is used here for dairy farms.

The results for the dairy farms are displayed in figure 9.6. There are differences in the financial robustness of farms. The number of dairy farms with a positive income after an external shock in countries such as Austria, Luxemburg and Ireland is higher than the European average. In especially Denmark the

number of dairy farms with a positive income after the shock is lower than the European average. Compared to other types of farming, the differences between countries for dairy farmers are very limited. As mentioned, Denmark is an exception and also Greece is noteworthy. For most types of farming the farms in Greece are rather robust or at least in comparison to other types of farming. For dairy farming, Greek farms are the least robust.

9.8 Conclusions specialised dairy farms

The results of specialised dairy farms show an increase in incomes during the period under analysis, 1990-2003, in Germany, Denmark, France, Italy and Spain. Dairy prices - prices for milk received by the farmer - were rather stable in this period. The development in farm structure, at least the growth of the herd size, is an important factor for the development of the incomes. The average herd size increased strongly in most countries. Dairy farmers in the Benelux countries as well as in Greece and the UK show a less favourable development. This is partly due to a less strong growth of herd size, partly due to a strong growth of production costs (mainly depreciation).

The rather stable milk price reflects the unchanged dairy policy in the EU till 2003 (quota system, before reductions in intervention prices of butter and skimmed milk powder). Subsidies are in general low in this sector, at least before the CAP Reform in 2003. Farmers in Italy received much higher prices than their colleagues elsewhere. Because of these higher prices Italian dairy farmers realised an income level comparable to that in some northern countries, which have a much larger herd size. Compared to other sectors the volatility of incomes in the dairy sector is low.

10 Volatility of farm incomes in the grazing livestock sector

10.1 Introduction

In this chapter the results of grazing livestock farms are presented. Volatility of incomes in this sector is not only caused by production and market circumstances. These farms are very much affected by changes in the European policy. In 1993, 1994 and 1995 the intervention prices of beef were decreased by 5% per year. The bull and suckler cow premiums were increased to compensate for the lower prices. Slaughter premiums were introduced with Agenda 2000. Besides the beef regime, the European Policy on sheep and goats is important for this type of farming. This policy was maintained during the nineties when premiums per ewe depended on market prices.

Output prices, for example for example for different types of meat, and prices of the inputs (for example feed) and the intensity and the amount of capital (buildings) have an influence on the results of the sector. Structural changes, such as changes in the size of farms as well as the productivity of farms had at least a comparable or even a larger impact on the results. At the end of the century the incomes were affected by the BSE crises, especially in the UK but also in other countries. This will be explained in more detail in this chapter.

The number of farms in the total farm population (in FADN) varies from member state to member state. Grazing livestock farms are most important in Ireland, France, and Spain and to a lesser extent in Italy and the UK. The share of this type of farms is in Ireland around 70%, in the UK 35% and in Belgium and France around 20%. In Spain, the Netherlands and Finland the share is just above 10%. The number of farms in Denmark is very low and will not be included in the analyses.

10.2 Volatility of incomes

The development of the nominal farm income shows very ambiguous results. Some countries show a significant increase and others a strong decrease. The increase is the highest in Spain, with a continuous growth of 10% per year. Belgium, France, Ireland, the UK and Luxemburg show a yearly increase around 5%

(table 10.1). Quite an extreme case is the Netherlands. The average income at the end of the analysed period was much lower than at the beginning of the nineties. The revenues of these farms decreased since the beginning of the nineties while the costs increased. The decrease in revenues was partly caused by lower beef prices, partly by the unfavourable conditions of the bull premium for the more intensive farms in the Netherlands. The increase in costs was mainly caused by higher interest costs and higher overhead costs. The direct costs only decreased slightly. The incomes in Sweden slowly increased to values above zero.

The absolute income at the end of the nineties is relatively high in the countries that showed a substantial growth during the nineties. The average income per country shows large differences. Low levels of income can be found in the Netherlands, Portugal and Sweden.

Figure 10.2 shows that especially the Netherlands, Luxemburg, Italy and the UK have a fluctuations of farm income of grazing livestock farms. Remarkably, the fluctuations of Germany and Ireland are rather limited although these countries were affected by the BSE crisis (see case descriptions in section 10.8 and section 10.9). Compared to other types of farming the size of grazing livestock farms are rather limited as well as the income levels.

10.3 Structural developments

In the nineties the number of grazing livestock farms decreased, except in the Benelux and Ireland (table 10.2). The reason for this increase is mainly the reorganisation of many dairy farms. The small dairy farms stopped the dairy activities and kept some fattening cattle. This behaviour resulted in a change of the type of farming to which the farm belongs. In the other countries the number of dairy farms is limited compared to the grazing livestock farms (except in Germany). In these countries fewer farms changed to grazing livestock.

The average size of farms shows an increase in all countries during the nineties (table 10.5). The growth was the strongest in Luxemburg, Portugal and Spain. Despite this growth the average size of grazing livestock farms is still very small in Portugal - (12 ESU compared to 43 ESU in France and 12 ESU in Ireland.

The total assets differ among the most important countries (table 10.2). Per hectare the total assets in Ireland and Italy are between €7,000 and €8,000. In the other important countries the assets are between €1,000 and €2,000. Per farm the total assets are high in the UK. In less important countries, namely the Netherlands and Luxemburg, the total assets are higher than in

Table 10.2	Data on farm structure of specialised grazing livestock farms per country										
	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average size (ha)		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	12.9	-1.7	59.2	4.7	1.67	0.9	73.6	6.1	551	7.0	82,0
France	69.1	-2.2	42.8	4.3	1.50	0.1	81.2	3.0	182	2.7	55,4
Italy	34.6	-5.0	26.7	2.2	1.68	-1.5	54.3	2.4	330	5.1	99,3
Belgium	7.3	0.3	73.1	3.9	1.59	0.5	59.2	4.3	236	4.6	54,3
Luxemburg	0.4	4.7	51.1	5.1	1.66	1.3	92.3	4.0	755	6.8	79,3
Netherlands	9.4	3.4	59.9	0.8	1.14	-2.5	25.6	3.1	583	4.8	67,0
Ireland	82.4	0.1	12.1	1.6	1.03	-0.3	36.7	-0.2	351	8.4	97,8
UK	29.2	-1.6	40.1	1.2	1.55	-1.2	198.2	-0.2	527	4.3	89,8
Greece	45.8	-1.0	14.0	3.5	1.63	-1.0	5.4	1.6	42	3.6	98,6
Spain	62.4	-3.1	17.7	4.9	1.33	0.8	54.9	9.2	178	7.4	96,7
Portugal	15.4	-6.7	12.0	6.0	1.31	-1.0	49.9	4.5	61	1.2	94,8
Austria	15.3		21.8		1.59		24.0		328		91,8
Finland	1.9		32.2		1.48		46.6		245		65,8
Sweden	3.4		18.8		1.17		78.9		287		77,3

Source: FADN-CCE-DG Agri; adaptation by LEI

the UK. In the Netherlands the assets per hectare are €25,000 whereas in Portugal this figure is only slightly more than €1,000.

10.4 Main grazing livestock regions

Table 10.3 shows results for the most important regions. What is noteworthy is the large area of grazing livestock farms in Scotland. In most regions these farms have rather low family farm incomes and at the same time high levels of subsidies. The volatility of income levels differs considerably from the high levels in Great Britain.

10.5 Within-farm volatility of farm incomes of grazing livestock farms

Table 10.3 shows large differences in the volatility in the grazing livestock sector. The coefficient of variation in the grazing livestock sector is further specified in figure 10.3. It shows that there are large differences within a country. This figure shows for instance that farm incomes on grazing livestock farms in the northern part of Spain are more volatile than in the other regions of this member state. In general, income volatility is higher in the UK and especially in Scotland, Ireland, the Netherlands and some regions of Germany and Sweden.

Figure 10.4 presents the coefficient of variation of total output on grazing livestock farms for the different regions in Europe. The values reflect a combination of factors, such as the climatic conditions, occurrence of diseases, the type of cattle (cows, sheep) per region etc. Comparison of both figure 10.3 and figure 10.4 reveals that the volatilities of farm income are much higher than those of production value.

Table 10.3	Data on specialised grazing livestock farms in important grazing livestock regions (1999) all values x 1,000, except ESU, ha and labour						
Region	Number of farms	Size		Family farm Income(x 1000)	Volatility income (%)	Assets (x 1000)	Solvability
		esu	ha				
Ireland	86140	13	36	9.8	12	319	98
Castilla-Leon	17880	17	32	38.3	8	172	97
Northern Ireland	12733	16	68	5.3	61	384	98
Sardegna	12650	18	46	28.2	21	324	100
Sterea Ellas-Nissi Egaeou-Kriti	12160	10	3	17.0	8	44	99
Midi-Pyrenees	10640	39	69	24.8	8	197	59
Makedonia-Thraki	10184	12	6	16.8	6	43	98
Auvergne	9440	35	83	25.4	12	168	59
Nederland	9340	53	23	10.0	43	621	73
Wales	9200	38	121	30.1	23	534	90
Limousin	9150	35	77	26.7	12	162	60
Belgium	7980	66	55	32.3	11	216	55
Pays de la Loire	7920	46	63	23.8	23	122	36
Extremadura	7830	20	187	35.1	12	207	99
Scotland	7270	41	441	12.3	51	587	89
West-England	6555	32	99	22.4	34	507	86
North-England	6220	39	201	27.4	34	500	88
Aquitaine	6210	33	44	18.3	21	153	67
Bourgogne	5550	50	111	33.4	18	174	50
Castilla-La Mancha	4580	31	12	50.8	27	163	100
Poitou-Charentes	3940	46	69	27.0	9	126	44
Rhone-Alpes	3770	32	84	22.3	20	169	55
Bayern	3380	40	51	15.7	51	535	85
Bretagne	2530	48	46	27.9	15	189	25

Source: FADN-CCE-DG Agri; adaptation by LEI.

Figure 10.3	Volatility of farm income of grazing livestock farms per region

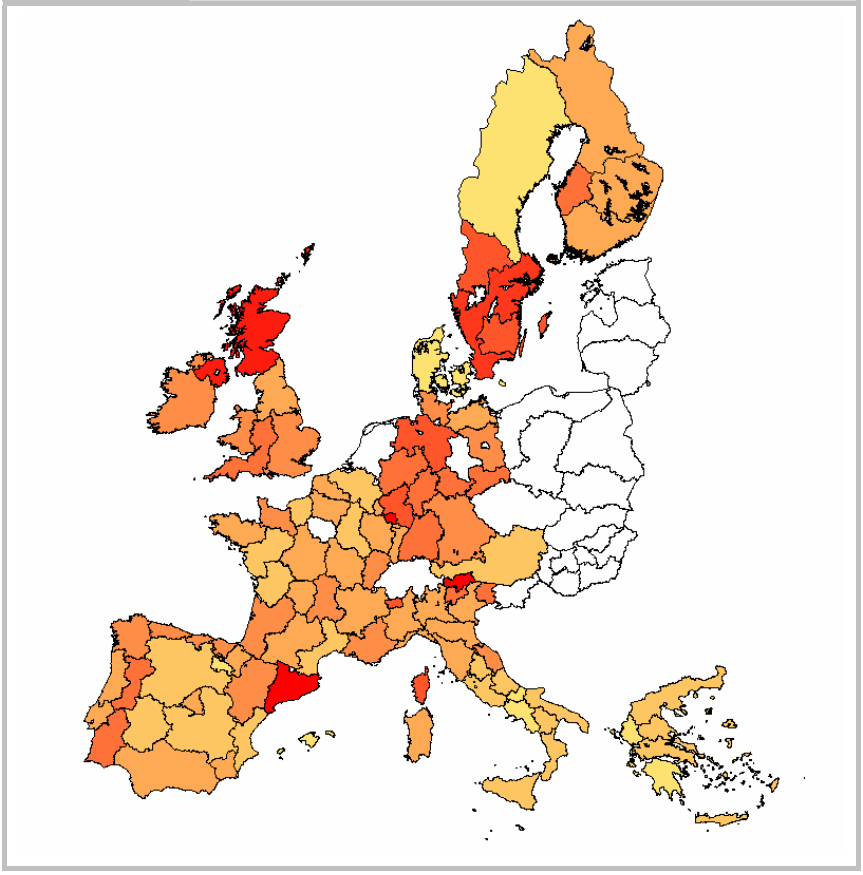
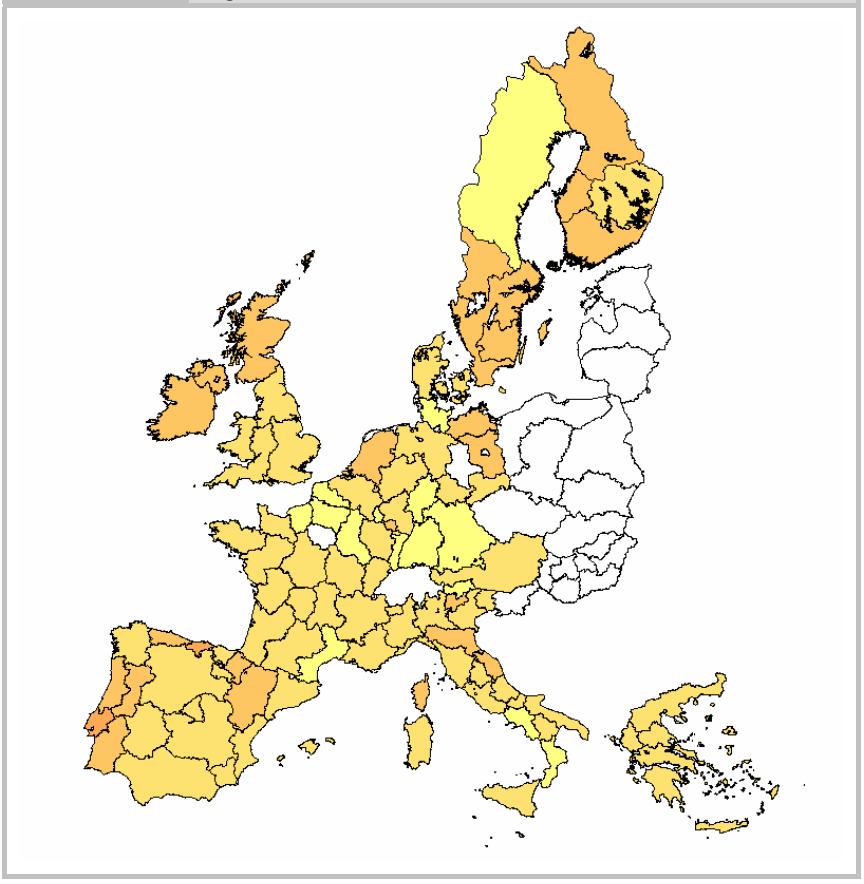


Figure 10.4 **Volatility of total output of grazing livestock farms per region**



10.6 Income crisis on grazing livestock farms

As illustrated in this report there are large differences between farms. It is of interest to have information on the robustness of farms; see section 5.8 for the method and distinction of farms in categories. The same approach as is used in that section on field crop farms is used here for grazing livestock farms.

The results for the grazing livestock farms are displayed in figure 10.5. Compared to other types of farming grazing livestock farms are rather robust. There are however differences in the financial robustness of farms. For countries such as Greece and Spain, but also Ireland and Portugal, the number of

livestock farms with a positive income after an external shock is higher than the European average, whereas in Sweden and the Netherlands the number is lower than the European average. Sweden in partical has a large number of farms with a negative income, even without an external shock.

10.7 Example of volatility: Foot and Mouth Disease in 2001 in the Netherlands

In March 2001 the animal sector - cattle, pigs, sheep and goats - in the Netherlands was unexpectedly confronted with the outbreak of Foot and Mouth Disease (FMD). Some regions, mainly in the centre of the country, had to deal with drastic governmental regulations to combat the disease. One of the regulations was a ban on the transport of animals - standstill order - during a couple of weeks in a (larger) region - so-called 'toezichtgebieden' or observation areas. Another measure was the destruction or 'stamping-out' of cattle in smaller regions around the infected farms (so called 'ruimingsgebieden' or stamping-out areas).

The income losses in the distinguished regions are different, depending on the type of measures and the period in which farms were restricted in their activities. Table 10.4 illustrates the losses per animal (dairy cow, sow, fattening pig, fattening calf and fattening steer). Table 10.5 presents the impact of the FMD on the incomes of average farms for the distinguished farm types. Compared with the normal income level of these farms (in table 10.5) the negative impact of FMD on incomes is very strong.

Table 10.4	Margin decrease (-) or increase (+) per animal in FMD affected areas (NLG per animal)					
		Dairy cows	**Sows**	**Fatten-ing pigs**	**Calves**	**Fat-tening Bulls**
Stamping out area	Groot-Oene	-505	-429	-84	-54	-87
Observation area	Groot-Oene	-24	-169	-27	-5	-44
Stamping out area	Oosterwolde	-441	-366		-49	-73
Observation area	Oosterwolde	-25	-144	-24	-4	-37
Stamping out area	Olst-Wijhe	-420	-345	-67	-47	-68
Stamping out area	Kootwijkerbroek	-388	-315	-61	-44	-61
Observation area	Kootwijkerbroek	-25	-119	-20	-4	-30
Stamping out area	Ee and Anjum	-219				-23
Annex 1 a)	excl. enclosed areas	-24	-144	-24	-5	-38
Annex 2	excl. enclosed areas	-24	-87	-14	-5	-38
Margin per animal with FMD		4,537	1,098	195	286	127

a) Region Annex 1 includes the northern, east and central provinces in the Netherlands; region annex 2 includes the provinces in the west and south of the Netherlands.

Table 10.5	Income per farm without FMD (family farm income in NLG1,000, 2000/1) and income effect of FMD in NLG1,000 per farm					
		Dairy farms	Pig breed-ing farms	Fatten-ing pig farms	Calves	Fat-tening Bulls
Income without FMD		73	79	56	65	ca. 40
Income effect in:						
Stamping out area	Groot-Oene	-28	-120	-84	-27	-13
Observation area	Groot-Oene	-1	-47	-27	-3	-7
Stamping out area	Oosterwolde	-24	-103		-24	-11
Observation area	Oosterwolde	-1	-40	-24	-2	-5
Stamping out area	Olst-Wijhe	-23	-97	-67	-23	-10
Stamping out area	Kootwijkerbroek	-21	-88	-61	-22	-9
Observation area	Kootwijkerbroek	-1	-33	-20	-2	-5
Stamping out area	Ee and Anjum	-12				-3
Annex 1		-1	-40	-24	-2	-6
Annex 2		-1	-24	14	-2	-6

The total loss of income on animal farms is estimated to be €230m (table 10.6, Huirne et al., 2001). This loss was the result of changes in returns as well as in costs (inputs). Farmers in the infected regions suffered a loss of on average 16.000 euro per farm. At the same time pig farmers in a part of the Netherlands (region annex 2) received higher prices for their fattened pigs and paid lower prices for the piglets than under normal conditions. This resulted in a higher income for this specific group of farmers - about €25m.

Besides the direct impact of FMD on the incomes of farmers, presented in table 10.6, animal farmers in the Netherlands had to pay levies amounting to €120m co-finance the Animal Health Fund. This fund together with the contribution of the EU is used to compensate farmers for the value of the animals in case of stamping out.

Table 10.6	Income effect per group per year (in €m) from March till December 2001 (excluding compensation animals)							
	Number of farms with solindingulates	Total	Effect per					
			Dairy cow	Sow	Fattening pig	Calf	Animal	Per farm
Annex 1	27,756	-38.74	-25.38	-37.63	-2.62	-5.79	-110.17	-3,969
Annex 2	25,023	-25.66	-36.4	-5.68	-2.24	-7.76	-77.74	-3,107
Stamping out areas	1,068	-6	-6	-4	-1	0	-17	-16,259
Observation areas	5,567	-6	-5	-9	-2	-1	-23	-4,196
Total	59,423	-76	-73	-56	-8	-15	-229	-3,848

Conclusion

Diseases such as FMD have an enormous impact on the incomes of farmers. Depending on the region of the farm the impact is negative for most farmers, but some farmers, however, have a financial profit as a result of higher prices of their products and lower input prices (costs). The consequence of this is a larger dispersion of incomes than under normal conditions.

10.8 Example of volatility: the impact of BSE around 2000 in Germany

The BSE affair had an impact on beef consumption and prices during some years. The first incidents of BSE took place in the UK in the nineties. These had an impact on the public opinion on food security around April 1996 (De Meere and Sepers, 2000). The main reason for the uncertainty was that the Creutzfeldt-Jakob Disease (CJD) was linked to BSE.

BSE was found on the European continent for the first time in the fall of 2000. The consumption of beef in Germany as well as in France and some southern member states fell strongly. The beef market in the EU had just recovered in the first half of 2000, while intervention stocks of beef declined during that period. On average prices of cows for slaughtering in 2000 in the Netherlands were 10% higher than in 2001 (Bolhuis, 2001). Nevertheless it is of interest to analyse the impact of BSE on farm incomes. In this example the development in Germany is analysed, mainly during the period 2000-2003.

Before presenting some results on the development in Germany, it should be noted that the CAP on beef was reformed precisely during the BSE affair in Germany. Decisions of Agenda 2000 that were implemented in 2000-2002 mainly included:

- a reduction of the intervention prices by in total 20%;
- an increase of the premiums per animal, for instance up to €210 for bulls;
- the introduction of slaughter premiums, - €80 per older animal and €50 per calf.

Selected regions and farms

To have a clear view on the impact of BSE on farm incomes the selected farms are specialised beef producing farms (type 4220) in Germany. These farms do not produce milk. This means that the level of income of the selected farms is for a large part dependent on the returns of cattle for slaughtering.[1]

Table 10.7 shows a number of characteristics and results of these farms for the period 1995-2003. The table makes clear that the size of the cattle herd is not stable over the years. In 2001 and 2002, the years just after the first BSE incidents in Germany, the number of (beef) cattle was much lower than in other years. Compared with 1999 the herd was on average about 20% smaller.

Results

Table 10.7 reveals that the level of total returns of the farms fell in the years 2000 and 2001 by nearly 25% compared to the level in 1990. Total returns (without subsidies and direct payments) however fell more, by 25-30%. Direct payments increased in this period as a consequence of the CAP Reform. The strong reduction in returns in the years 2000 and 2001 however did not result in a reduction of incomes. In contrast with the expected fall, the incomes improved somewhat in 2000 and 2001. Incomes remained at a rather normal level for this type of farms in Germany.

[1] In the period 1990-2003 about 40 farms in the FADN sample represent about 3,000-4,000 farms of this type in Germany. However, in the years 2000 and 2001 the sample was smaller - only 17 and 27 farms. A consequence of this is that the number of farms per specific region is too small to report on it. In this report therefore we take into account the whole population of specialised beef producing farms (type 4220) in Germany.

Table 10.7	Characteristics and results of specialised beef cattle farms (type 4220) in Germany in 1995-2003								
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Number of represented farms	3,429	2,405	2,264	2,834	2,457	2,833	3,098	2,046	4,091
Number of farms in the sample	40	33	30	28	28	17	27	32	88
Number of other cattle (23-29+31-32)	129	188	213	165	172	145	135	215	169
o.w. number of beef cattle (25-27)	46	76	90	68	78	58	53	78	64
Gross cattle units (23-29+31-32)	63	93	105	83	86	71	66	107	87
Total returns (x 1.000 Euro)	85,8	123,7	130,9	100,7	117,7	96,9	93,1	129,6	117,1
o.w. total subsidies and direct payments	14,8	18,3	17,9	18,1	17,5	21,4	24,5	46,3	40,9
o.w. subsidies and direct payments on cattle	7,1	8,6	8,4	6,8	9,0	13,2	20,0	37,0	28,3
Net value added (x 1.000 Euro) a)	17,0	33,1	32,6	23,3	23,6	22,8	21,0	27,6	30,6
Family farm income	7,6	20,1	14,9	12,1	8,7	12,7	10,2	8,6	13,2

a) Net value added is the remuneration to the fixed factors of production (work, land and capital), whether they be external or family factors.
Source: FADN-CCE-DG Agri; adaptation by LEI.

Conclusions

The fall in the returns per farm on specialised beef producing farms (type 4220) in Germany was compensated by higher direct payments (subsidies) and apparently lower costs of production. Because of the variation in herd size over the years, it is difficult to conclude that the BSE affair resulted in a deterioration of the income position of the beef producing farmers in Germany.

10.9 Example of volatility: the impact of BSE around 1996 in the UK

BSE was a dramatic incident for agriculture and the food sector in the UK during a rather long period. Food security, at least the safety of food for the health of the population, was questioned. BSE under cows was found for the first time in 1986 by veterinaries in the UK.[1] Similar diseases had been found before: the disease scrapie among sheep and CJD among humans. But the relation between BSE, scrapie and CJD was observed in 1996 by researchers of the University of Oxford. It was discovered that scrapie could result in BSE when cows were fed with animal meal produced with ingredients of sheep with scrapie and that (a new type of) CJD could be the result of the consumption of beef from cows with BSE. As a consequence the consumption and prices of beef fell dramatically in April 1996. Moreover, the UK was obliged to stop its exports of cattle as well as of beef and veal.

Selected regions and farms

The selected farms are specialised beef producing farms (type 4220) in the UK. These farms do not produce milk. This means that the level of income of the selected farms is for a large part dependent on the returns of cattle for slaughtering.[2]

[1] BSE is a relatively new cattle disease. It was first recognised and defined in the United Kingdom in November 1986. Over the next few years the epidemic grew considerably and affected all parts of the country but in different degrees. It reached its peak in 1992, when 36,680 cases were confirmed in Great Britain, and since then has shown a steady decline (DEFRA, website, 2007)

[2] In the period 1994-2003 between 19 and 81 farms in the FADN sample represented about 4,000 of this type of farms in the UK (table 10.8).

The UK counts 6 FADN regions: Northern England, East England, West England, Wales, Scotland and Northern Ireland. Because of this regional division it is not possible to report on (all) individual regions: the number of farms per specific region is too small. In this report we take into account the whole population of specialised beef producing farms in UK for the years 1994-2003 as well as in West England and Northern Ireland. These are the regions with sufficient farms in the sample and with a large part

For the UK as a whole the returns and the farm incomes on the selected specialised beef cattle farms fell in 1997 (table 10.8). These farms maintained lower returns and a lower income level until 2002 than before 1997. In 1996 returns and incomes were just higher than the years before, partly due to higher subsidies and direct payments on cattle. Apart from that, family farm incomes in the years 1997-2002 were depressed. A major reason for this is appears to be the BSE affair.

In Northern Ireland income levels of the specialised beef cattle farms are in general lower than in the UK as a whole and in West England (table 10.9). The fall of income in Northern Ireland is smaller. It is noteworthy that, in contrast to the UK and West England, the income level in Northern Ireland in 1996 was not higher than in previous years despite the increase of subsidies and direct payments on cattle during that year.

It should be noted that other factors may have had an impact on farm incomes during the observed years, e.g. the reform of the CAP as mentioned - mainly on beef with lower intervention prices and higher premiums per animal - other animal diseases (mainly FMD in 2001), the rate of exchange between the euro and the pound and weather conditions. The fall in incomes from 1997 was however not caused by a (strong) reduction of the size of the herds.

Conclusions

The BSE affair in the UK in 1996 had a negative consequence for farm incomes of the specialised beef cattle farms during a number of years, from 1997 on words. In some regions - not presented in this paper - incomes were even negative during a couple of years. Other factors may have had an impact on incomes during the years observed, but it seems that the influence of these is less than the negative income effect of BSE.

10.10 Conclusions on grazing livestock farms

This type of farm represents farmers with mainly cattle. They are heavily dependent on the beef and sheep regime of the CAP. Beef intervention prices were decreased in the period 1990-2003, but they were compensated by

of the total of this type of farms in the UK. However, because of the sample of farms for West England and Northern Ireland, for these regions only the period 1994-1999 is taken into account.

Table 10.8 Characteristics and results of specialised beef cattle farms (type 4220) in the United Kingdom in 1994-2003

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number of represented farms	4,066	3,349	3,873	6,191	4,053	4,198	4,848	3,686	3,395	4,216
Number of farms in the sample	81	75	69	72	69	68	24	19	32	57
Number of other cattle (23-29+31-32) per farm	108	107	121	116	115	103	81	89	98	164
o.w. number of beef cattle (25-27) per farm	54	57	62	69	68	60	60	69	69	105
Gross cattle units (23-29+31-32) per farm	63	64	72	73	71	62	48	54	61	100
Total returns (x 1.000 Euro)	54,6	52,4	63,6	56,6	53,9	56,9	41,4	48,1	50,8	92,0
o.w. total subsidies and direct payments	8,6	9,7	17,6	17,0	17,7	16,7	9,3	15,3	21,2	31,8
o.w. subsidies and direct payments on cattle	7,9	9,0	16,2	15,6	16,4	15,3	10,2	14,6	20,5	28,8
Net value added (x 1.000 Euro) a)	18,1	16,1	23,6	15,6	14,7	15,1	6,3	5,7	11,6	25,3
Family farm income	12,7	11,2	17,8	8,8	7,2	9,6	4,4	1,4	6,2	12,1

a) Net value added is the remuneration to the fixed factors of production (work, land and capital), whether they be external or family factors.

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 10.9	Characteristics and results of specialised beef cattle farms (type 4220) in Northern-Ireland in 1994-1999					
	1994	**1995**	**1996**	**1997**	**1998**	**1999**
Number of represented farms	1,924	1,031	1,240	1,042	956	1,256
Number of farms in the sample	31	27	18	18	19	17
Number of other cattle (23-29+31-32) per farm	77	112	101	121	119	93
o.w. number of beef cattle (25-27) per farm	39	61	66	71	69	60
Gross cattle units (23-29+31-32) per farm	46	68	62	76	75	57
Total returns (x 1.000 Euro)	37,4	47,2	51,2	55,2	57, 6	50,0
o.w. total subsidies and direct payments	6,4	10,0	14,3	18,6	20,7	15,9
o.w. subsidies and direct payments on cattle	6,2	9,6	11,7	16,4	19,8	15,4
Net value added (x 1.000 Euro) a)	11,4	12,3	12,8	11,6	17,7	11,1
Family farm income	9,3	8,4	6,6	3,4	7,7	4,9

a) See table 10.8

Source: FADN-CCE-DG Agri; adaptation by LEI.

higher premiums on bulls and suckler cows as well as the introduction of slaughtering premiums. In most member countries incomes improved in the period 1990-2003. The Netherlands is an exception; the criteria to be eligible for premiums on bulls were too restrictive for many farms. The BSE affair had a large impact, at least for the UK. Beef prices went down at the end of the nineties and consumption decreased in some periods.

In absolute terms the income levels of grazing farms in most countries are lower than in the dairy sector. This is not surprising, because grazing farms are in general smaller in ESU and hectares than dairy farms. Before the 2003 CAP Reform, the impact of subsidies - mainly in the form of premiums - was much higher for grazing farms than for dairy farms.

With respect to extent to which grazing livestock farm can cope with an external crisis, the conclusion can be drawn that grazing livestock farms are rather robust compared to many other types of farming. This also applies to the countries that were affected by BSE.

11 Volatility of farm incomes in the granivore sector

11.1 Introduction

In this section the results of farms specialised in pig and poultry production are presented. The incomes of these farmers in the countries and regions depend largely on the changes in the market prices of pigs, eggs and broilers. Changes in the size of farms and productivity also have a serious impact on the farmers' income. This will be explained more in detail in this chapter. The CAP has fewer direct effects in this sector. The decrease in cereal prices (influencing feed costs) was an important policy change in the last decade.

The number of intensive livestock farms in the total farm population varies widely from country to country. Denmark, Netherlands, Germany, France and Spain are important granivore countries. More than 50% of the European granivore farms can be found in these countries. Compared to other sectors within a country, granivore farms are especially important in the Netherlands (11% of the farms), Belgium (9%) and Denmark (7%). Despite the large number of granivore farms in Spain and France they only represent 2% of the farms in their countries. Some regions in these member countries contribute significantly to the pig production, for example Lower Saxony (Germany), Brittany (France) and Catalonia (Spain). The main exporters of pig meat are Denmark and the Netherlands. Poultry production is especially important in France, Germany and Italy. In many countries only a small part of the farms is specialised in pigs and poultry. In Germany and Denmark the mixed farms have a large share in the local pig and poultry production (see chapter 12).

11.2 Volatility of incomes

Table 11.1 gives an overall indication of the development of farm incomes in the granivore sector, which is the sector with the strongest fluctuations in the financial results. The fluctuations are caused by the pig cycle phenomenon and the occurrence of some crises with animal diseases. Therefore the figures concerning the trend should be treated with caution. As some countries have different accounting years (for instance July-June in Germany) comparability between

countries for a specific year can also be problematic. Comparing the average performance of 1990-1992 with the average performance for 2001-2003, Italy[1], the UK, Spain and Portugal show a positive development. Denmark and the Netherlands show a strong decrease in average farm incomes.

11.3 Volatility of income of pig farms

Pig farms can be classified into various types of farms. First, there are the specialised farms with breeding pigs (sows) to produce and raise the piglets. Second, these piglets can be sold to specialised farms to fatten pigs to produce pig meat. Third, there are the integrated farms with both breeding and fattening pigs. In addition to this there are mixed farms with pigs, other animals and arable land. Many mixed farms are found in for example Denmark and Germany. Some mixed farms mainly grow their own feed, in which case the label 'mixed farm' is debatable, as pigs are the only real market output.

The market prices in the pig sector are dominated by the so-called pig cycle. In the years 1993, 1998 and 1999 the pig farms lost a lot of money because of the weak market prices. In some member countries such as the Netherlands and Belgium the policy with respect to the surplus of minerals and ammonia strongly affects the farm incomes. However, also in other countries such as Denmark, Germany, France and Spain the environmental policy is more or less restrictive. Spain showed on average an increase in farm income for pig farms (table 11.3), partly due to the fast growth of the average farm size. In Spain in particular, the pig production grow very fast. Spain turned from an importer to an exporter of pig meat.

The farm income level in Italy in recent years was much higher than in countries with a comparable average size, which was mainly caused by the attractive pig price. The pig prices in Belgium are also higher than in most other countries, although the farm income of the Belgium farmers decreased sharply in the late nineties like in most other countries. The dioxin crisis in Belgium caused much damage to the whole livestock industry in 1999. The income of granivore farms in the Netherlands was very poor in the late nineties. Two years in a row the average farm income was negative. An export country such as the Netherlands had to suffer severe problems to sell products in weak markets. In 1997

[1] The results of Italian farms presented in this chapter seem to be rather extreme for the last reported years, but the results are consistent with the standard results as presented by the European Commission.

the Netherlands had to face an outbreak of swine fever which caused a dramatic stamping out of the pig population (see section 11.9 for the case description). A year later the Dutch pig production recovered and the export of pig meat was confronted with oversupplied markets in EU, so pig prices tumbled. In 2000 the farm incomes recovered from the very low incomes in 1998 (and in some countries in 1999).

Figure 11.3 shows the average size and income of specialised pig farms in relation to the fluctuation in average income. The figure clearly illustrates the large size of pig farms in Italy and Denmark. The fluctuations of incomes is large in Italy, Denmark, the Netherlands, France and Belgium. Spain, which has a similar farm size, has a relatively low income fluctuation. During the classical swine fever crisis and the following market response in 1998 the farm income in Italy and Finland showed a much smaller decline than in other countries.

11.4 Structural developments of pig farms

The number of specialised pig farms in the Netherlands, Denmark, the UK and Portugal declined sharply (table 11.3). In these countries the number of specialised pig farms in 2003 was much lower than in 1990. In all other countries, except in Spain, a minor decrease of the number of farms could be observed. The number of pig farms in Spain increased. Since 1998 most specialised pig farms can be found in Spain, followed by Germany, France and the Netherlands. However, in some countries - for example Denmark and Germany - an important proportion of the pig production is located on mixed and arable farms. In the Netherlands, Belgium and Italy the specialised farms have a large share in the pig production.

The average farm size in pig farming per country is very different, but increasing rapidly (table 11.3). The growth in production was realised by a higher number of animals. In most countries the average size of the pig farms almost doubled since 1990! This means a fast structural development in the pig sector. The highest growth could be observed in Portugal and Spain. The other countries show a somewhat lower but still substantial structural growth.

In several countries the average size of specialised pig farms surpassed 100 ESU. Denmark has the largest size per pig farm, partly because of the area arable land used for growing pig feed. Pig farms in Germany also have a large area of grain used for feed production. The member countries Portugal, Spain and Austria however have quite small farms with 50 ESU or less per farm.

The number of workers per specialised pig farm showed a slow increase in most member countries, although this increase is much lower than the increase in size (table 11.3). Italy, Spain and Portugal showed a significant growth in labour input per farm. This is line with the large scaling up. Labour input in most countries is for a large part provided for by family workers, except for Denmark and the UK, where paid work force is also important. Labour costs are substantial in these countries.

Table 11.3 Farm structure of specialised pig farms per country

	Number of farms (x 1,000)		Average size (ESU)		Average working units		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	8.5	1.9	105.2	9.5	1.70	1.1	532	6.3	71.2
France	4.8	-0.6	126.7	6.0	2.11	1.8	268	0.3	
Italy	2.4	0.7	273.8	8.3	5.30	5.1	1759	11.8	98.2
Belgium	2.7	-0.6	102.4	5.9	1.42	0.3	232	3.1	40.0
Netherlands	4.0	-2.4	114.6	6.5	1.65	1.5	841	10.3	23.4
Denmark	2.1	-3.1	269.8	7.6	2.98	3.0	1653	11.1	14.6
UK	1.5	-3.1	109.1	5.3	2.93	-0.3	392	4.4	59.9
Spain	12.3	5.1	106.2	11.2	1.82	3.2	303	4.9	87.6
Portugal	0.8	-7.9	59.3	11.3	3.12	4.4	152	8.6	95.1
Austria	5.3		45.2		1.51		412		89.9
Finland	1.6		83.1		1.90		438		62.3
Sweden	0.6		101.9		1.72		668		41.3

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 11.3 also gives information about the total assets (value of buildings, machinery, livestock and land) per specialised pig farm. It shows that the pig farms in Denmark and Italy have the highest assets per farm, much more for example than in France, Belgium and Portugal. The pig farms in Portugal are on average small-scaled. In France and Belgium the total value of the assets is rather low compared with the average farm size. In most countries, with the exception of France and Belgium, the assets increased strongly, especially in the Netherlands, Italy and Denmark. A higher level of investments and the higher value of buildings and land are the main reasons for this growth.

The number of pigs per farm increased in almost all countries (table 11.4). Italy, Spain and Portugal show the largest average increase of more than 10%. The average number of animals in Spain tripled since the beginning of the nineties. This is one of the main factors for the rather favourable income development in Spain. The expansions in pig size in the UK and Denmark progressed at a much slower rate.

Table 11.4 **Average number of fattening pigs and breeding pigs on specialised pig farms per country**

	Number of fattening pigs		Number of breeding pigs	
	2003	**% trend**	**2003**	**% trend**
Germany	306	5.9	161	5.3
France	1,098	6.2	166	2.6
Italy	2,776	11.2	481	7.3
Belgium	883	4.4	142	0.2
Netherlands	982	6.3	251	3.9
Denmark	921	3.9	415	8.1
UK	1,155	3.1	230	2.0
Spain	1,074	11.5	132	2.9
Portugal	493	10.2	153	9.8
Austria	154		55	
Finland	288		102	
Sweden	466		175	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 11.4 also provides information on the number of breeding pigs per farm. In general the developments are similar to the figures on fattening pigs, except for Spain with changes in breeding pig numbers. In Denmark and Italy the pig farms have the most breeding pigs per farm, just before the UK and the Netherlands.

11.5 Development of prices

Tables 11.5 and 11.6 present some information on prices of fattened pigs and piglets in euro per animal. It can be seen that the level of prices per year is different and that prices per country differ. To compare prices, more information on quality, weight of animals, etcetera is required. Indicators for productivity

gains may be the number of piglets per sow or per farm per year or the production of pig meat weight per farm. Given the lack of data it is not possible to provide information on productivity.

Table 11.5 **Price per fattening pig on specialised fattening pig farms per country per year (in €)**

	2000	2001	2002	2003
Germany	116	102	84	95
France	132	158	112	106
Belgium				109
Netherlands	115	118	102	94
Denmark	104		100	87
Spain	107	121	101	104
Finland		127	122	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 11.6 **Price per piglet on specialised breeding pig farms per country per year (in €)**

	2000	2001	2002	2003
Germany		54	41	38
France		49		
Belgium	42	48	38	
Luxemburg	34	44	43	
Netherlands	44	49	39	34
Denmark	47	58	45	38
UK	32	35	36	34
Spain	33	40	37	30
Austria	61	72	60	51
Finland		78	74	58
Sweden		48	55	50

Source: FADN-CCE-DG Agri; adaptation by LEI.

11.6 Regional results of specialised pig farms

Table 11.7 provides some information on the main pig producing regions in the EU-15. The table shows important differences in the structure of pig farms in terms of hectares (large farms in Denmark versus small farms in the Netherlands and Castilla-Leon) and economic size. Also, the volatility differs strongly between regions (see also next section).

11.7 Within-farm volatility of farm incomes on intensive livestock farms

Table 11.7 shows large differences in the volatility in the pig sector. The coefficient of variation in the intensive livestock sector is further specified in figure 11.4. It shows that there are large differences within a country. Compared to other types of farming, volatile incomes occur in almost all regions of Europe, from Greece to Spain and from France to the Nordic countries. An exception is a major part of Italy, with very low volatilities.

Figure 11.5 presents the coefficient of variation of total output on intensive livestock farms for the different regions in Europe. The values reflect a combination of factors, such as the occurrence of diseases, the type of animals (pigs, poultry) per region etc. Comparison of both figure 11.4 and figure 11.5 reveals that the volatilities of farm income are much higher than those of production value. Farm income is much more volatile because it is a residual indicator. The regional differences in total output volatility are limited. This indicates that especially market circumstances influence the profitability of intensive livestock farms. For most farms the income situation is affected by the European market. Only few areas are able to create their own market, which is less attached to more global market developments.

Table 11.7 Data on specialised pig farms in important pig farm regions (2002)

Region	Number of farms	ESU	ha	Family farm Income(x €1,000)	Volatility income (%)	Assets (x €1,000)	Solvability	Pig price
Netherlands	5,930	128	8	-23.6	.	1,024	38	101
Austria	4,177	42	21	28.3	.	350	88	113
Belgium	3,280	104	13	31.2	48	229	35	118
Cataluna	3,045	60	27	38.8	.	280	83	103
Bretagne	2,874	119	34	5.5	67	285	-6	110
Denmark	2,864	193	73	-13.7	149	1,250	23	99
Aragon	2,462	86	20	51.9	37	193	85	99
Niedersachsen	1,830	79	36	20.0	88	448	75	101
Castilla-Leon	1,448	81	5	10.5	62	367	82	90
Nordrhein-Westfalen	865	91	42	-5.1	68	639	77	90
Comunidad Valenciana	846	72	13	62.7	.	362	93	81
Etela-Suomi	835	64	43	39.5	.	361	69	121
East-England	767	145	39	30.3	64	654	60	80
Bayern	735	68	27	19.1	54	518	88	82
Sodra Och Mellersta Sveriges Slattbygdslan	526	93	42	-14.0	.	643	39	111
Emilia-Romagna	474	172	35	188.4	.	2041	100	.

Source: FADN-CCE-DG Agri; adaptation by LEI.

Figure 11.4	Volatility of farm income of intensive livestock farms per region

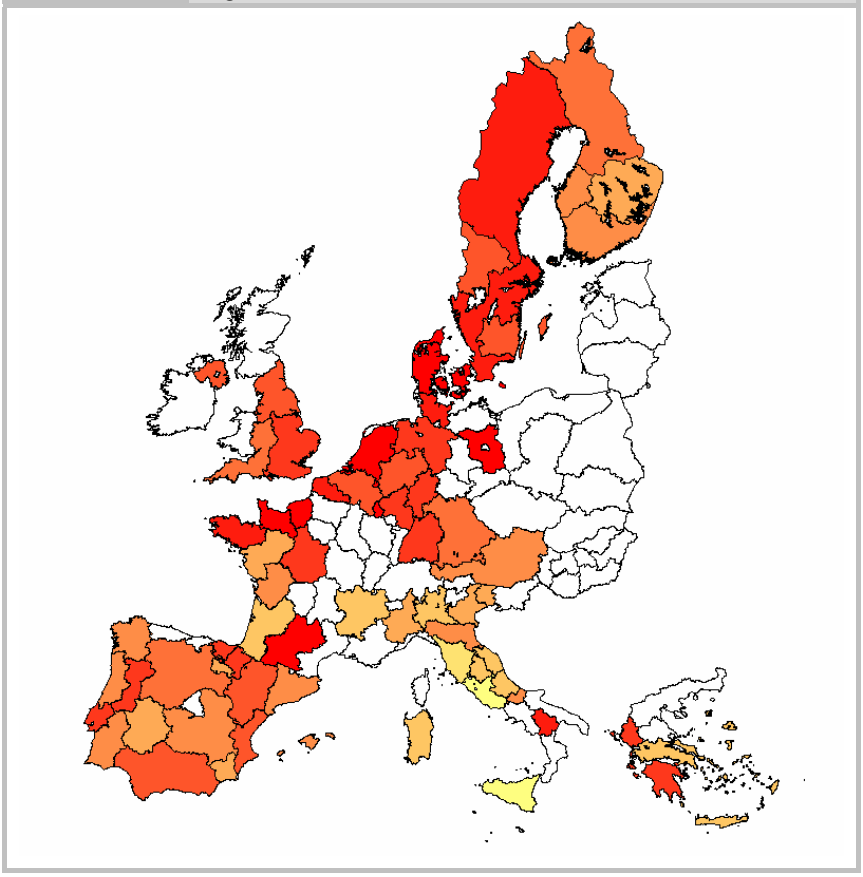
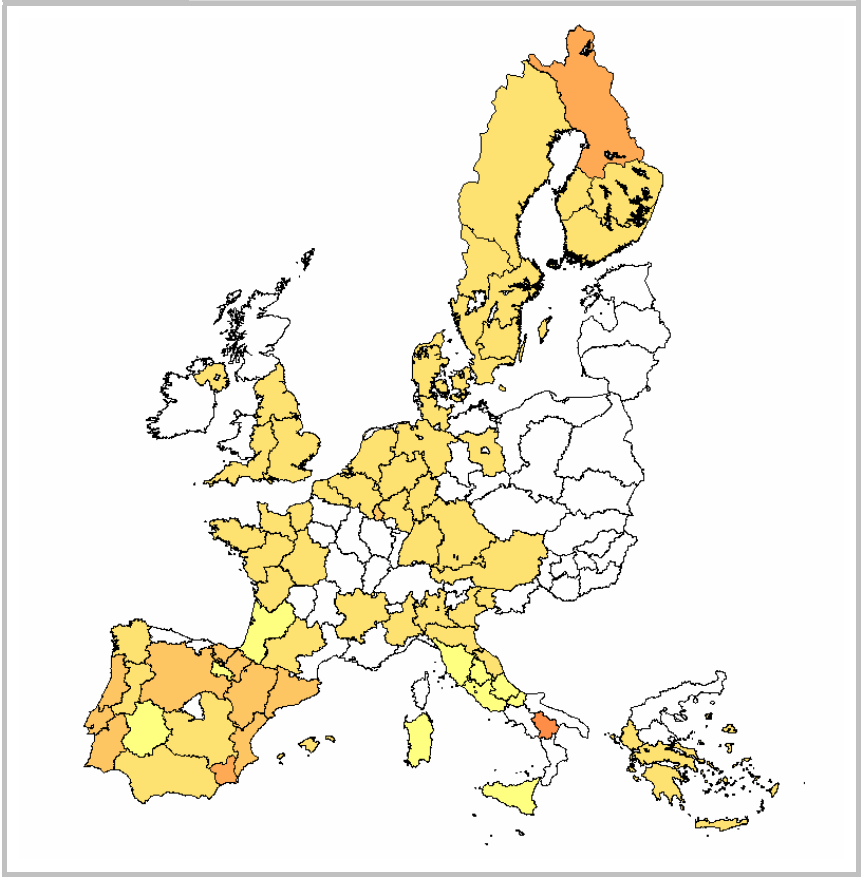


Figure 11.5 **Volatility of total output of intensive livestock farms per region**



11.8 Income crisis on intensive livestock farms

Figure 11.6 analyses the financial robustness of farms. As illustrated in this report there are large differences between farms. Given the high volatility of incomes in the intensive livestock sector it is of interest to analyse the robustness of farms; see section 5.8 for the method and distinction of farms in categories.

Compared to other types of farming the resulting picture is dominated by red - deep red for farms which already have a negative income before a simulated crisis and orange for farms which would end up in financial distress due to an external crisis. The number of intensive livestock farms with a positive in-

come after an external shock is higher in countries such as Finland, Portugal Spain, Italy and Austria than the European average. In countries such as Denmark, the Netherlands and Sweden this number is lower than the European average, with even large numbers of farms with a negative income even without a simulated shock.

11.9 Example of volatility: Swine fever in 1997 and 1998

In early 1997 pig farms, mainly in the southern part of the Netherlands, were infected by classical swine fever. More than 10% of the specialised pig farms were confronted with stamping out of animals. As a consequence these farms had no production and therefore no revenues for a certain period of time. Another group of pig farms, more than 30% of the pig farms, had to deal with several regulations such as a ban on transport of animals as well as a ban on reproduction of pigs and a buying up of animals. The transportation ban lasted several months and resulted in the buying-up scheme because of animal welfare reasons; farmers were not able to keep their pigs because of over 120kg and the piglets were over 25kg. The market value of these pigs and piglets was compensated by the EU and national funds. Farmers had to deal with a loss of returns during these periods. The negative impact on the income per pig farmer was around €50,000 on farms with stamping out (they received on average more than €280,000 as compensation). On farms with (only) the buying up scheme of pigs and piglets the negative impact on incomes was on average some €7,000 (they received on average around €160,000o as compensation).

During the swine fever period most pig farmers, outside the region with measures, had a rather high income. The main reason for that is the high level of prices in this period (figure 11.7). For a part this was caused by the reduced production volume in the Netherlands, an exporting country with a market share in the EU at that time of around 10%. During the swine fever period around 2m. pigs and piglets, 15% of the stock, were destroyed. The higher price level stimulated production in other EU countries in 1997 and 1998. Prices went down in 1998 as a consequence of the increased supply on the market. In November 1998 prices reached at the lowest levels since the Second World War: around €11 per piglet and €0.7 per kg of pig meat. Incomes of pig farmers in 1998 were very negative (De Bont, 1999 and 2000; Mangen and Burrell, 2003).

Figure 11.7 **Development of price of pigs and cost of production (including and excluding labour)**

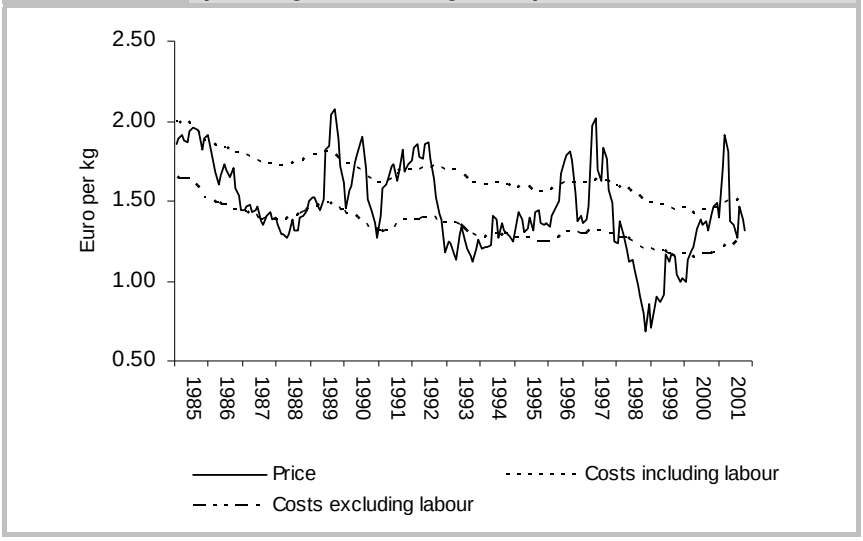


Table 11.8 **Distribution of pig farms, deviation from average (1996-1998)**

Deviation from average family farm income per entrepreneur	1996/97	1997/98	1998/99
More than 100,000	12	16	5
50,000 till 100,000	13	9	17
0 tot 50,000	12	11	37
-50.000 till 0	28	24	25
-100.000 tot -50.000	26	23	7
Less than -100,000	9	17	9
Total	100	100	100
Average Family farm income per entrepreneur in guilders	134.900	107.500	-91.600

Source: FADN, LEI.

Conclusion

During the period of swine fever (1997) the incomes of pig farmers show a larger difference than under normal conditions (table 11.8). The disease results in a higher fluctuation of prices during and just after the period of the disease. In this case, not so much the animal disease caused the very low income levels,

as the market response and the oversupply in the subsequent periods, which resulted in a collapse of prices and incomes.

11.10 Example of volatility: Aviain influenza (AI) in 2003

The outbreak of Aviain influenza (AI) in the Netherlands at the end of February 2003 resulted in the stamping out of 17m. laying hens and 12m. broilers - about 30% of the poultry flock in the Netherlands. In this example we concentrate on the impact of AI on the egg market and the incomes of egg producers. The impact on the poultry meat market and the incomes of producers of poultry meat are not discussed.

During the period March till June 2003 around 60% of the farms with laying hens in the Netherlands were confronted with stamping out. The volume of eggs in the Netherlands in 2003 was 35% lower than was foreseen without the outbreak of AI. As a result of this the prices of eggs increased strongly during the year (figure 11.8). Forty per cent of the producers of eggs - those who were not directly affected by the measures to combat AI - had a favourable year due to high prices. Their incomes were high, especially during the second half of the year (figure 11.9).

The egg producers in the AI-affected regions did not benefit from these higher prices. Many egg producers in the central and southern regions of the country lost their laying hens during 6 to 8 months. During this period they could not produce and they did not have revenues from eggs (on average €400.000). At the same time they saved costs, mainly on compound feed (on average €200.000). On balance they had a loss of income of €200.000; more than 4 euro per laying hen (De Bont, 2003).

The higher level of egg prices in 2003 stimulated investments in production. The volume of production in the EU increased and as a consequence the prices of eggs decreased strongly in the year 2004 (figure 11.8). This resulted in negative margins and incomes. In comparison with the results of egg producing farms in 2003, the margin per farm was €100.000 lower in the second and third quarter of 2004. This means that the margin per laying hen was more than 2 euro lower (see figure 11.9).

Figure 11.8 **Development egg prices in the Netherlands**

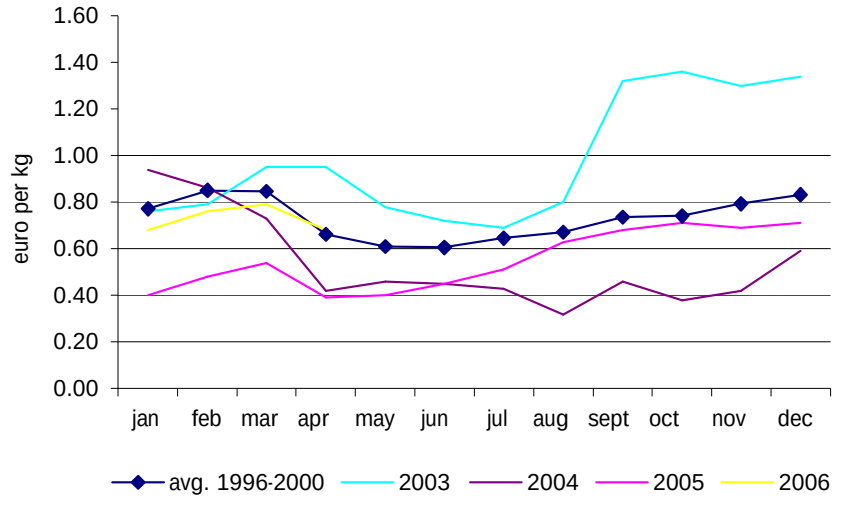
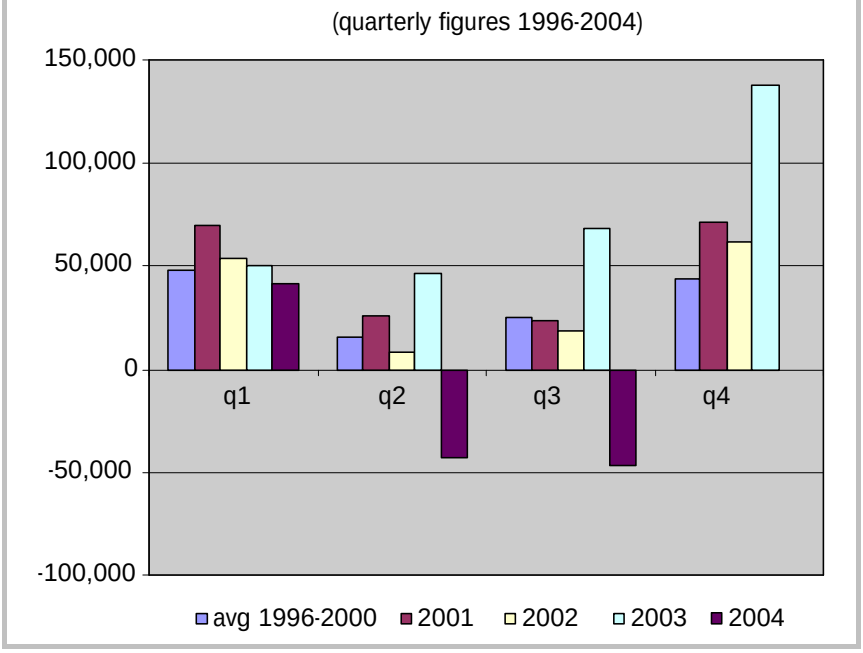


Figure 11.9 **Contribution margin per laying hen farm in the Netherlands (quarterly figures, 1996-2004)**



Conclusion

The Avian influenza outbreak resulted in large differences in incomes of poultry farmers during the outbreak (2003). Depending on the region, farmers felt a severe loss or a positive, favourable result. The AI resulted however in a severe drop in egg prices in the period after the outbreak (2004), which was felt by all egg producing farms.

11.11 Conclusions on granivore farms

Granivore farms are farmers with mainly pigs or poultry. They are in fact not dependent on the CAP, besides the impact of the decisions on cereals (through the effect on feed prices). Prices of products (pigs and eggs) strongly fluctuate, following a cyclical pattern, the so-called pig-cycle.

Farms strongly increased in size during the period 1990-2003 to improve productivity. The volatility of incomes in the pig farm sector is very high as a consequence of the fluctuations in prices as well as in costs of production (mainly feed) and in some regions the low solvability (resulting in high interest costs).

The volatility of farm incomes in the intensive livestock sector is high. This is the case in almost all regions of Europe. Italy is an exception with rather stable incomes for pig farmers.

The robustness of pig farms is limited in most areas of Europe. The number of farms ending up in some kind of financial distress due to an external crisis is high.

The case descriptions on Avian influenza and classical swine fever illustrate that the direct impact of the occurrence of the disease is limited due to compensation payments. Some farmers (outside of the affected areas) even benefit from the disease because of high prices. The real income crisis is caused by the market response. Due to the temporary high prices the supply on the European market increases, which results in a large decline in prices and farm incomes.

12 Volatility of farm incomes on mixed farms

12.1 Introduction

The mixed farms are, as the name already indicates, difficult to describe. These are farms which perform a combination of activities on their farms so that they do not belong to a specialised type of farming. Developments in income are therefore more difficult to analyse because there are distinct differences in the structure of the farm.

The importance of mixed farms is decreasing. Also, farming is characterised by specialisation. A good example is the trend in Spain and Portugal. After accession to the EU the opening of markets contributed there to further specialisation and the number of mixed farms declined stronger than elsewhere in the EU. However, in a few countries mixed farming is still significant. In countries such as Germany, Belgium, Denmark and Portugal more than 20% of the farms are considered as a mixed farm. In Italy, the Netherlands, Ireland, the UK, Greece, Spain and Finland the number of mixed farms is less than 10%. The number of mixed farms is decreasing in all countries.

With respect to income risk this group of farms is very interesting. Diversification of agricultural activities is often suggested as a risk management instrument, especially if the risks of the different activities are not correlated. Given the combination of crops, livestock and other activities these farms can be affected by price and yield fluctuations of different products, but the risk is limited to a share of the activities on the farm. This gives these farms a certain flexibility in surviving difficult circumstances. Diversification and specialisation are opposing pressures. Looking at the structural development during the last decades, the specialisation trend seems to be stronger than the diversification.

12.2 Volatility of farm incomes

The evolution of nominal incomes is positive in most countries. Farms in Spain were able to strongly improve their income position. Only in the Netherlands and Denmark the nominal income situation deteriorated. Farms in Denmark, the Netherlands and the UK were confronted with a strong increase in interest and

depreciation costs. Farms in Spain were able to increase their production with hardly any increases in costs except for the direct costs. In most countries the mixed farms realised positive incomes. An exception is Sweden, where the average income is negative in almost all observed years. The volatility of incomes in the mixed farming sector is heavily influenced by the developments in the pig sector. Mixed farms in Germany, Denmark and the Netherlands have a substantial number of pigs. In 1998 the pig prices were very low, as described in the previous chapter. This had a large impact on the average incomes of mixed farms in these countries.

Fluctuations are strongly correlated with the size of the farm (see figure 12.2), mainly caused by the selection of products produced on the farms. In Denmark, the Netherlands and Germany many pigs are kept at mixed farms. The impact of the swine fever crisis as described in the previous chapter can be seen in the results of mixed farms. France shows low fluctuations due to the limited number of pigs on mixed farms.

12.3 Structural developments

Table 12.3 gives an indication of the decrease in the number of mixed farms. Only in Luxemburg there was a slight increase, even though the number of farms involved is very limited. Spain showed a marginal growth. In Greece the number of mixed farms decreased at the slowest rate. The reduction in the number of mixed farms was strongest in Portugal, Italy and Denmark, followed by France and the Netherlands.

The average size of farms (expressed in ESU) increased in all countries. The strongest increase could be observed in Germany, Spain, Italy and Portugal. Farms in the Netherlands and the UK continued their growth and passed the 100 ESU threshold for an average farm. Small farms can still be found in Portugal and Greece. The average farm size of commercial farms in these countries mainly increased during the last few years.

Despite the growth in the size of farms in all countries the growth in labour input is lagging behind. Labour productivity increased. Only in Germany the labour input per farm increased substantially, because of the strong increase in farm size. Farms in Denmark and Spain showed a minor increase. Farms in Italy, Ireland, the UK, Greece and Portugal decreased the average labour input. These tables together clearly show that labour productivity increased substantially.

Table 12.3	Data on farm structure of mixed farms per country										
	Number(x 1,000) of farms		Average size (ESU)		Average working units		Average size (ha)		Average total assets (x €1,000)		Solvability
	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003	% trend	2003
Germany	39.5	-2.4	106.0	8.9	2.37	3.5	100.0	7.9	722	7.1	79,6
France	43.7	-3.4	89.9	6.4	1.88	0.9	99.1	4.7	262	1.6	44,3
Italy	25.4	-7.6	46.5	7.4	1.90	-0.6	41.8	5.2	460	7.9	99,0
Belgium	6.3	-2.8	94.1	4.7	1.64	0.0	50.6	3.7	320	2.0	56,9
Luxemburg	0.2	2.7	57.4	5.8	1.59	1.1	82.3	3.3	749	5.7	82,7
Netherlands	4.4	-3.0	100.4	4.1	1.66	0.4	33.0	3.7	1204	9.0	62,1
Denmark	7.3	-5.2	115.5	6.0	1.55	1.5	85.6	5.9	1093	10.4	35,5
Ireland	3.1	-2.2	50.7	1.8	1.55	-1.7	68.4	-0.2	959	5.4	96,3
UK	8.1	-2.6	102.3	2.1	2.30	-1.9	148.9	1.0	928	2.9	86,6
Greece	24.7	-1.8	12.5	3.4	1.54	-1.4	7.8	1.2	62	0.8	99,4
Spain	30.8	0.6	27.9	7.1	1.51	1.9	60.4	8.1	207	4.8	97,1
Portugal	13.3	-11.1	9.1	6.6	1.61	-1.3	40.2	9.6	58	3.0	98,3
Austria	8.0		32.3		1.55		33.0		338		89,1
Finland	4.5		35.6		1.50		56.5		274		70,3
Sweden	3.7		54.5		1.50		90.1		507		61,6

Source: FADN-CCE-DG Agri; adaptation by LEI.

The growth in the economic size of farms is in line with the growth in hectares. The strongest increase could be observed in Portugal, Spain, Germany and Denmark. This means that the growth in economic activity was not so much realised by a process of intensification but more by a growth in the agricultural area of the farms. A large difference can be observed between the Netherlands and the UK. Farms in both countries have a similar size in ESU. Farms in the UK are however much bigger in hectares. This difference can be explained by the mixture of activities conducted on these farms. (Intensive) livestock farming as a part of mixed farming is more important in the Netherlands.

The assets of mixed farms increased strongly during the nineties. A steep increase could be found in Germany, Italy, the Netherlands and Denmark.

12.4 Mixed farms in main regions

Table 12.4 looks into important mixed farming regions - sorted by total economic size, e.g. the number of farms multiplied by the average size of the farm in ESU. The major regions can be found in Germany and the surrounding countries. The regions within Germany (Bayern, Niedersachsen, Nordrhein-Westfalen and Baden-Württemberg) show clear differences in the structural characteristics and the economic performance of farms. The volatility of farms differs strongly. Denmark in particular shows a high volatility due to the low income levels and the high share of pig production on mixed farms.

Table 12.4	Mixed farms in important mixed farming regions (1999)						
Region	**Number of farms**	**esu**	**ha**	**Family farm income (x 1,000)**	**Volatility income (%)**	**Assets (x 1,000)**	**Solva-bility**
Bayern	16,131	50	45	15.6	28	635	88
Austria	10,940	29	29	26.2	.	305	88
Niedersachsen	10,233	73	53	10.9	54	579	79
Nordrhein-Westfalen	9,381	65	46	11.1	46	627	84
Denmark	8,810	89	71	-9.6	408	838	37
Castilla-Leon	8,790	30	46	43.5	16	290	97
Belgium	7,400	92	47	36.7	14	312	57
Baden-Wuerttemberg	6892	53	49	11.3	32	490	81
Bretagne	5,962	91	59	28.7	25	269	21
Pays de la Loire	5,614	77	81	27.7	19	209	34
Nederland	5,444	109	31	10.9	51	1,317	71
Aquitaine	4,730	51	56	24.7	17	170	58
Midi-Pyrenees	4,350	51	71	19.6	23	226	68
Nord-Pas-de-Calais	3,324	90	73	26.8	24	295	51
West England	3,190	109	159	24.8	49	1,085	82
Poitou-Charentes	2,850	94	121	41.8	14	235	46
Lorraine	2,580	108	153	41.6	21	329	45
East-England	2,479	157	164	29.5	49	1,343	83
Centre	2,470	94	136	35.5	16	278	45
Bourgogne	2,210	87	150	28.6	24	253	46
Picardie	2,100	111	101	33.6	23	312	39
Haute-Normandie	2,050	112	121	45.8	19	304	38

Source: FADN-CCE-DG Agri; adaptation by LEI.

12.5 Within-farm volatility of farm incomes on mixed farms

Table 12.4 shows large differences in the volatility in the mixed farming sector. The coefficient of variation in the mixed farming sector is further specified in figure 12.3. Comparing this figure to the figure of the other types of farming reveals that there is a strong similarity between the volatility of the pig sector and the arable sector. In countries like Denmark, the Netherlands and Germany the volatility of mixed farming is high due to the high share of pig production.

Figure 12.4 presents the coefficient of variation of total output on mixed farms for the different regions in Europe. For mixed farm these values reflect the whole spectrum of possible effects such as: the climatic conditions, occurrence of diseases, the type of crops and livestock on the mixed farms per region etc. The total output the volatility in the regions in the north-western part of the EU is higher than in other regions of Europe. This is related to the pig production as described in chapter 11 and the financial differences of arable farms as described in chapter 6.

Figure 12.3 **Volatility of farm income of mixed farms per region**

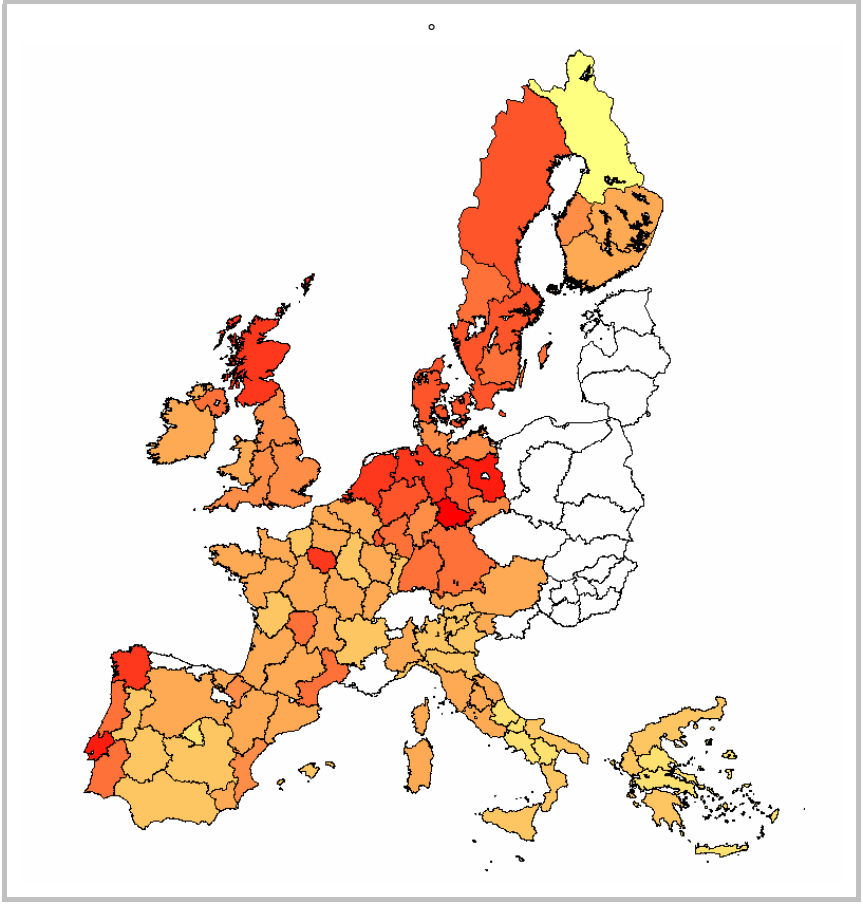
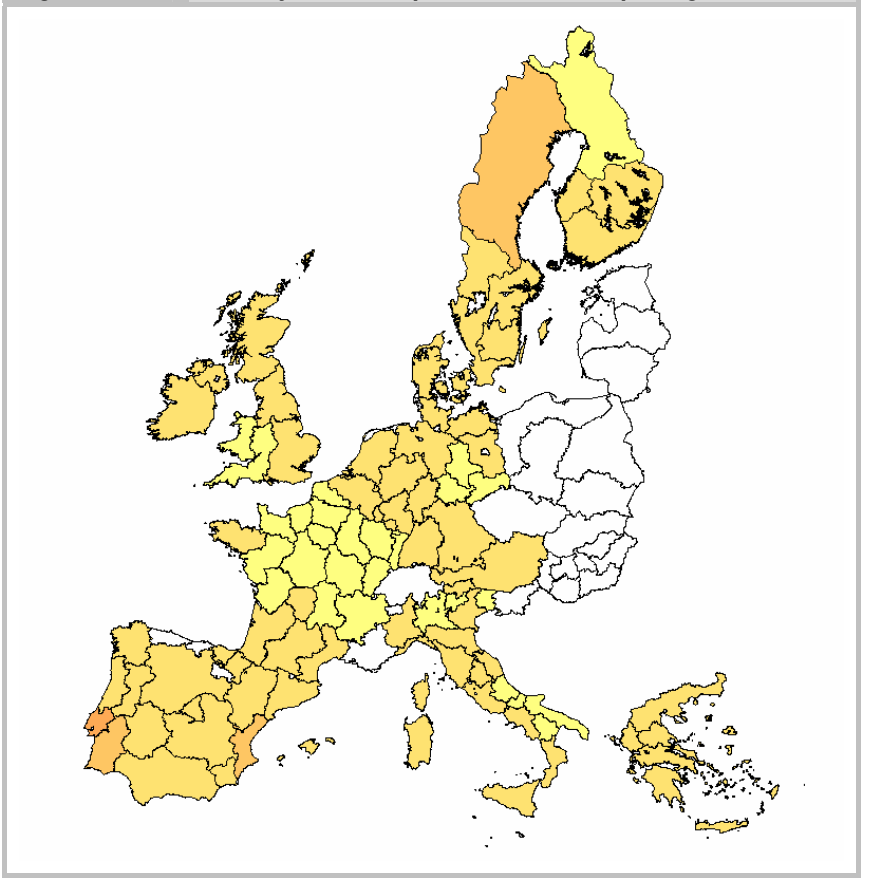


Figure 12.4 **Volatility of total output of mixed farms per region**



12.6 Income crisis on mixed farms

Figure 12.5 shows the impact of an external crisis in case of a reduction of total output. This simulated crisis is a bit more complicated for mixed farms because due to the wide variety of structures of mixed farms, it is unlikely that one event would affect all farms in a region. The type of external event that would cause a 30% drop in production varies from farm to farm.

The results for the mixed farms are displayed in figure 12.5. There are differences in the financial robustness of farms. The number of mixed farms with a positive income after an external shock is higher than the European average in countries in the south of Europe such as Portugal, Spain and Greece. In coun-

tries such as Denmark, the Netherlands and Germany the percentage of mixed farms with a positive income after the shock is lower than the European average. For these countries the results are more similar (but to a lesser extent) to the financial robustness of pig farms.

12.7 Conclusions mixed farms

Given the trend to specialise production, the number of mixed farms is decreasing in all countries at a stronger rate than the farming population in total. Specialisation is attractive to increase the efficiency of the production factors, labour, capital and land. In Germany, Denmark, Belgium and Portugal the share of mixed farms is still more than 20%. Farm sizes of mixed farms increased rather strongly.

Mixed farming is often suggested as a way to reduce risks. If the risks of products produced on a single farm are not correlated then the total risk becomes smaller. The figures show that the number of mixed farms has steadily decreased. This indicates that during the last decades specialisation seems to have been a more important driving force than diversification.

In most member countries incomes of mixed farms improved, exceptions to this are Denmark and the Netherlands. The picture on the volatility of mixed farms is mixed, in some regions - Denmarks, for instance - it is very high, in most regions however it is rather low as a result of the different results of the animal and crop products produced on this type of farms.

13 Impact of off-farm income

13.1 Introduction

The aim of this chapter is twofold. First, to briefly discuss the increasing importance of the farm household perspective and to consider in more detail the possible consequences for on-farm risk management by farm households. Second, to examine the potential sources of information on off-farm labour income in different countries, and consider to what extent this information might be used to cast light on whether off-farm income possibilities affect on-farm risk management in practice.

13.2 Background

It has long been recognised by agricultural economists that many decisions on the farm should be seen as arising from a farm household perspective rather than simply viewing the farm as only a business (see inter alia Gasson et al., 1988; Lass et al., 1991; Hill, 2000; Huffman, 1991). Members of the farm household hold residual claims to farm profits and manage the resources of the farm, while typically providing most of the labour required on the farm, and contributing their own resources for investment in the business.

In Policy terms, the farm household perspective was of peripheral interest while agricultural policy was primarily based around commodity support programmes. However, the continuing pressure over the last 15 years from international trade negotiations to reduce the use of commodity subsidies has led to the increasing importance of direct agricultural support, e.g. single farm payment, which is viewed as decoupled from production and therefore not trade-distorting. This move from traditional support mechanisms has been accompanied by an increasing emphasis on the multifunctional role of agriculture to justify agricultural support.

These developments have increased the policy relevance of the farm household perspective. First, while the farm is viewed as a profit maximising business, direct payments should have no production effects. However, when the perspective is widened to the farm household, there are a range of circumstances where such payments may indeed change the farm production decisions. As described in more detail below, these include the effects of risk on uncertainty

on risk averse households, and also in other cases where labour and credit markets function imperfectly, e.g. where farm households have restricted access to credit. Second, part of the multifunctional role of agriculture emphasises how farm households are important in maintaining employment, population and economic activity in rural areas (EU Commission 2000; 2003). Hence, the increasing interest in the decisions of farm household members to work off-farm, and the explicit concern about the welfare and well-being of farm households, rather than the more restricted concern about the level of agricultural income (Boisvert, 2002).

13.3 Off-farm income sources and on-farm behaviour

From a farm household perspective, theory predicts that households will use a variety of mechanism to manage risk (Fafchamps, 2003). Specifically, in terms of the implications for on-farm decision making, the possibility of diversification of sources of income to include non-farm sources is likely to increase the willingness of (risk averse) farmers to accept risk on-farm, particularly where non-farm income sources are less volatile than on-farm activities. This type of mechanism has long been recognised and recent studies have attempted to draw out the empirical implications (Mishra and Goodwin, 1997; Mishra et al., 2002; Andersson et al., 2005). Here the following simple example illustrates the basic argument. Consider the following risky situation where farmer may either opt for choice A where he makes a profit of β for certain or choice B where the farmer's profits are 2β with a probability of ½, but may fall to $½\beta$ with a probability of ½. Although choice B has a higher expected value $5/4\beta$, assume that the farmer's aversion to risk means that he is indifferent between the two choices (e.g. assume that the farmer's utility function is $U(x)=\ln(x)$). Now assume that the farm is to receive an amount of non-farm income w for certain. If this is additional to the existing income, the farmer will strictly prefer choice B (the option with greater risk) on-farm because of reducing risk aversion as income increases. If off-farm income substitutes for existing income, e.g. through off-farm work,[1] this may still reduce the overall risk of the farmer's income and choice B will be preferred. Hence, not unexpectedly, the availability of a less risky off-farm income source means that the farmer is likely to be willing to accept more risk on-farm.

[1] For example, where on farm income is reduced by a proportion α where $\beta = \alpha\beta + w$

This potential impact of off-farm income sources on on-farm risk management is clearly likely to be less where non-farm income is relatively unimportant in total household income. Hence, such effects are likely to be less important as farm size and income from farming increases.

Asset accumulation and borrowing also provide important methods through which farm households cope with risk (Fafchamps, 2003). Hence, off-farm may also increase the ability of farms to cope with risk where it affects the farm's access to credit. For lenders, off-farm income may be attractive if is viewed as more stable than on-farm sources. Moreover, often the information problems which induce lenders to restrict credit are fewer for many off-farm income sources, e.g. stock returns, wage income (if the individual has a well-defined labour contract). Hence, particularly for farms with little collateral or where land markets are not developed, the presence of off-farm income is likely to increase the availability of credit. By improving the ability of farm households to cope with risk in such circumstances, farmers are likely to be willing to accept more on-farm risk than otherwise would be the case. The evidence suggests that credit constraints impact on certain of types of farm, e.g. small farms, tenants, (Blancard et al., 2006; Petrick, 2005; Benjamin et al., 2002). Hence, any impact of off-farm income sources on on-farm risk management via this mechanism is also likely to vary systematically across the population of farms. Therefore, in terms of the case-study countries in the project, on-farm risk management effects of off-farm income sources, would be expected to be strongest in those countries with the smallest farms and where agricultural credit markets are least developed, e.g. in the new member states.

13.4 Availability of data

To explore these potential effects requires microeconomic data on both production decisions and off-farm income sources and possibilities of farm households across the case-study countries. As is well known, while individual member states, e.g. the Netherlands, do have detailed farm level information on both on-farm and off-farm income, most EU countries do not collect reliable information on non-farm income. This is reflected in the FADN data available at EU level, which has great detail in terms of on-farm activities and income sources but no information on off-farm income. Hence, any detailed analysis of the potential impacts of off-farm income on on-farm risk management must be restricted to the countries such as the Netherlands where national data is available.

While there is a general lack of comparable data on on-farm and off-farm activities of farm households across in the EU, as suggested by Nagy and Vrolijk (2004), it is possible to use the general economy-wide survey information available from the Luxembourg Income Survey (LIS) to provide an overall picture of the relative importance of off-farm income across the case-study countries.

Luxembourg Income Survey

Luxembourg Income Survey (LIS) is a non-profit cooperative research project with a membership of 30 countries. The LIS project began in 1983 under the joint sponsorship of the government of the Grand Duchy of Luxembourg and the Centre for Population, Poverty and Policy Studies (CEPS).

The LIS contains a databank with information from Household Income Surveys from the early 1990s from a number of countries, including Austria, Germany, Poland, the Slovak Republic, the Czech Republic, Slovenia, Finland, Spain, France, Sweden, Hungary, Switzerland, Luxembourg, the UK and Norway. These surveys provide information on income, demographic, labour market and expenditure information.

In principle, the LIS is an attractive source of data because efforts have been made to harmonise the data for all of the countries covered, making many of the variables in the data sets more directly comparable across countries. However, as Nagy and Vrolijk (2004) discuss, there are difficulties in comparing the information from LIS with FADN data. In particular, the basic definition of what constitutes a farm is not consistent across the two datasets. Within the LIS, the basic unit is the household. Farms are defined by whether a household receives self-employment income from agriculture. Although the overall sample size of the surveys in each of the available countries is large, because the proportion of households engaged in farming - however defined - varies considerably across the countries, the sample size of farm households obtainable from the LIS is rather limited in certain cases. Nevertheless, it is the only available data source comparable across countries and its potential as a source of information on off-farm incomes in the case-study countries should be explored. This is undertaken in tables 13.1-13.3.

Table 13.1 describes the available data for the case-study countries for the period 1989-2000, where data are available for all 5 countries, by year, total sample size and sample size of potential farmers (defined as households where agricultural self-employment income is not equal to zero). Not surprising for countries where the economic importance of agriculture is small, such as the Netherlands and Germany, the number of farm households identifiable in the data is also rather limited. Further, perhaps because the sampling procedures

do not stratify on agriculture in the surveys, for these counties (and Spain) the sample size of households identified as having some income from farming is also quite varied. In part because of this and because the sample sizes in the most recent available years are 'reasonable' for all countries, for the descriptive analysis which follows only the latest available year is used.

Table 13.2 reports the means and standard deviations by the main elements of farm household income in the case-study countries. Despite the small number of observations for Germany and the Netherlands, the figures reported are consistent with expectations. For example, average household incomes and incomes from farming are highest in Germany and the Netherlands. Below each mean value reported is the associated cross-sectional standard deviation.

These indicate that there is considerable within-country variability in each of the income sources. It would also appear to be generally the case that wage and salaries are the most important source of non-farm income in all case-study countries. It is also interesting to note the difference in the relative importance of off-farm income in the two newer EU states, Hungary and Poland, with off-farm income on average larger in Hungary than on-farm earning.

In table 13.3, the correlations between the various elements of income on farm households in the samples are reported. If off-farm income plays a role in on-farm risk management, one would expect that these off-farm income elements should be weakly correlated with on-farm income. As expected generally, the correlations are small, although perhaps the correlations between wages and on-farm income are larger than might be expected a priori. However, there is no particular pattern to these across countries, with both negative and positive connotations evident.

As discussed above, comparing the LIS data with the information in the FADN is difficult since the definition of what constitutes a farm is different in the FADN data. Furthermore, in the FADN, very small farms are excluded from the sample. While a robust comparison between these two data sources is not possible, it is possible to attempt to roughly gauge whether excluding smaller farms influences the importance of the sources of income of farm households. To do this, table 13.4 repeats the information on the means and standard deviations by the main elements of farm household income for the sub-sample of households, which excludes households with farm self employment income in the lowest decile. Although approximate, this should primarily exclude smaller farms from the sample. From table 13.4, it appears that although the other elements of farm household income decrease in importance for the sample with larger agricultural self employment income, non-farm elements such as wages and salaries do not decrease significantly in importance overall (and in some cases increase in absolute value).

Table 13.1	Available data				
	Germany	**Hungary**	**Netherlands**	**Poland**	**Spain**
Year	1989	1991	1991	1992	1990
Sample Size	4,411	2,019	4,378	6,602	21,153
Farm Households a)	61	294	0	999	1,227
Year	1994	1994	1994	1995	1995
Sample Size	6,379	1,992	5,187	32,009	6,000
Farm Households	47	170	59	8,675	15
Year	2000	1999	1999	1999	2000
Sample Size	10,985	2,103	5,007	31,428	4,822
Farm Households	103	192	96	3,119	186

Source: Luxembourg Income Study.

a) Defined as households where self-employment income from agriculture is not zero.

Table 13.2	Structure of farm household income: means and standard deviations				
	Germany	**Hungary**	**Netherlands**	**Poland**	**Spain**
	2000	**1999**	**1999**	**1999**	**2000**
Wages & Salaries a)	1.1647	1,689	13,251	996	5000
	(17,860,5)	(2,136.1)	(18,932.4)	(1,655.7)	(8,195.5)
Farm Self Employment Income	22,083	759	22,610	4,371	14,865
	(23,877.7)	(1,213.5)	(32,416.9)	(8,044.9)	(17,469.1)
Non-farm self employment	2,201.2	127.4	82.2	126.7	1,879.3
	(11,205.7)	(568.6)	(805.7)	(846.9)	(8,225.6)
Cash Property Income	3,196.7	97.6	2,590.9	4.7	1,354.3
	(6,036.9)	(231.6)	(9,411.2)	(86.3)	(6,880.4)
Gross Income	47,702.2	4,269.6	44,330.6	7296.2	27,611.5
	(28,627.0)	(2,793.9)	(41,392.3)	(8,049.3)	(24,413.0)
Disposable Income	39,199.6	4,269.6	35,178.9	6,992.8	27,611.5
	(19,915.4)	(2,793.9)	(29,695.1)	(8,016.3)	(24,413.0)
N	103	192	96	3119	186

Source: Luxembourg Income Study. ECU. Standard Deviation in brackets.

a) Gross wages and salaries for Germany and the Netherlands otherwise net values.

Table 13.3	Farm household income correlation structure				
	Germany	Hungary	Nether-lands	Poland	Spain
Wages, Farm self employment	-0.21	0.18	0.19	-0.11	-0.02
Wages, Non-Farm self employment	-0.12	0.10	0.01	-0.05	-0.05
Wages, Property	-0.09	0.08	-0.03	0.01	-0.04
Farm, Off-farm Self Employment	0.08	0.08	-0.06	-0.01	0.28
Farm self-employment, Property	0.02	0.17	-0.04	-0.004	0.12
Off Farm SE, Property	-0.10	0.14	-0.01	-0.01	0.11
Source Luxembourg Income Study					

Table 13.4	Structure of farm household income (excluding bottom 10%): means and standard deviations				
	Germany	Hungary	Netherlands	Poland	Spain
	2000	1999	1999	1999	2000
Gross wages & Salaries	1,0866.9	1,694.3	14,120.4	926.4	4810.6
	(16,558.0)	(2,108.1)	(19,964.8)	(1,597.6)	(8,185.0)
Farm Self Employment Income	24,599.9	857.1	29,418.7	4,837.9	19,327.3
	(24,063.1)	(1,262.3)	(32,963.7)	(8,351.0)	(18,041.6)
Non-farm self employment	2,464.4	141.9	103.9	125.0	2,007.4
	(11,836.0)	(603.7)	(905.6)	(857.8)	(9,097.2)
Cash Property Income	2,978.3	103.8	3020.2	4.7	1,728.8
	(5,530.3)	(243.6)	(10,475.8)	(88.3)	(7,900.6)
Disposable Income	39,852.9	4,446.4	40,741.0	7,336.0	32,053.8
	(19,994.4)	(2,844.6)	(30,222.6)	(8,346.6)	(25,844.7)
Source: Luxembourg Income Study. ECU. Standard Deviation in brackets. a) Gross wages and salaries for Germany and the Netherlands otherwise net values. Sample excludes Households with farm self employment income in the lowest decile.					

13.5 Discussion

Despite the usefulness of the LIS database in providing basic descriptive information on the structure of farm household income, its limitations are obvious. In particular, its lack of detail on on-farm operations, and cross-sectional nature, means that it is not possible to effectively explore the extent to which off-farm income sources do indeed affect on-farm risk management. This requires an in-

tegrated dataset, which is only available at national level. Country comparisons are more difficult due to lack of harmonisation of data sources. Given the changes in the CAP and the large impact of off-farm income and wealth on the risk of farms more research is needed.

14 Executive summary and discussion

14.1 Introduction

Instability of agricultural markets and fluctuations of the prices received by farmers are major reasons for the volatility of incomes in the farm sector. The analyses per type of farming in chapters 4 to 12 of this report show some interesting aspects on this. These items are discussed in section 14.2. Recommendations are found in section 14.3.

14.2 Conclusions

Differences between types of farms

The volatility of income differs widely between sector. This conclusion can be drawn based on an analysis of the development of average farm incomes, but the conclusion becomes even stronger when the analysis is based on within-farm income fluctuations. For instance dairy farmers have in general a more stable income than for instance pig farmers. A major reason for this is the fact that dairy (milk) prices are stabilised by the CAP. The CAP does not manage the pig market in such a way that prices don not fluctuate. The Reform CAP, with a dismantling of the systems of price stability, may lead to a smaller difference between types of farms. However, there will still be large differences between sectors due to the extent it is possible to change the supply of an agricultural product in the short term.

Another reason for differences in volatility between types of farms is the dependency on specific inputs: for example compound feeds on the specialised pig and poultry farms, energy on horticulture firms producing in greenhouses. Fluctuations in prices of these inputs may result in a larger change in income on the types of farm mentioned than on other types, as for instance grazing livestock farms or field crop farms.

Furthermore, differences in volatility between types of farms are caused by the margin of income: the returns of products minus paid costs (and including depreciation) as a percentage of the returns. In general the more specialised larger farms (with salaried employees, long-term loans and often with rented land) have a smaller income margin than the 'traditional family farms'. Farms with a substantial amount of labour can for example be found in horticulture and

in the granivore sector. Such larger farms with small margins have a larger volatility in their incomes than the smaller farms.

Structural changes in agriculture and markets

The volatility in incomes in agriculture will increase over the years. Some important reasons for this conclusion are:

- *the dismantling of the CAP*
  Prices of products such as cereals, milk and beef will not be protected and stabilised by the CAP anymore in the future. Prices of these products may show larger fluctuations than in the past. Fluctuations in prices will result in a (larger) volatility of incomes of a large group of farmers, which are specialised in field crops, dairy, other grazing livestock and mixed farms. In most member countries these types of farms are (still) the majority of the farming population (chapter. 4, table 4.2).
- *increased productivity and scale of production*
  Given the characteristics of markets of farm products and the impact of many other factors on the sector (see chapter 3); farmers are increasing their productivity and their scale of production. Larger amounts of investments are necessary to achieve this. The income margin per unit of product is decreasing, for a part by the fact that farm prices do not follow the general development of prices (inflation): Prices of farm products in real terms will become lower, as was the case in the past.

Growing differences and risks on incomes in a dynamic sector

The developments, described in the chapters 4 till 12 of this report per type of farm, show a strong change in the structure of the sector in the period 1990-2003. Many farms have disappeared, because farmers stopped their activities and had no successors. On the other hand: other farms expanded. They use the production factors and especially the land of the farmers who left the sector. For most products, productivity gains resulted in an increase of production volume, maintaining prices of farm products at a low level.

There are reasons - amongst others the CAP Reform, the enlargement of the EU, the results of WTO negotiations, productivity gains as a result of new technologies - to expect at least a comparable shift in the farm structure in the years ahead. The general trends are: (1) each year some 3% of farms 'leave the sector' (on these farms older farmers have no successors) and (2) a rather fast growing average size of farms that continue. The growth per individual farm is however very different. A lot of farms will maintain their size (these are in general the small-sized farms) over a rather long period and a part of the farms,

mainly the larger-sized, will expand. They make use of the financial opportunities to invest.
A consequence of this may be a growing difference in the (absolute) levels of farm incomes. In some member states specific types of farms show already very large differences in income in one year. A clear consequence of the growth of individual farms using larger amounts of investments and increasing debts (and a lower solvability) is a higher level of financial risks.

The explanations in chapters 4 to 12 make clear that each type of farming has to deal with a number of specific risks, besides the general, normal 'economic' risks on prices of products, costs (input prices), and interest rates, as mentioned before. The specific, incidental risks are of different nature, for instance: veterinary (outbreaks of animal diseases, stamping out of herds), phytosanitary, food safety (for instance dioxin in animal feed) and climatic (rain, frost, hail etc. destroying harvests or slowing down growth and resulting in very low yields). Such risks depend on the type of farming, and have strong regional impacts.

Conclusions on income volatility and income crisis

Farmers are confronted with a wide range of factors that affect their income. Besides a continual increase in productivity, fluctuations in yields due to climatic conditions and fluctuations of prices of outputs and inputs strongly affect the levels of incomes. Contagious diseases affecting the production of crops and animals are external events that can cause crises on (groups of) farms

The analyses of individual farm data show strong fluctuations in farm income. Large differences are shown between different countries, regions and sectors. Furthermore, the quantitative analyses show that there are strong differences between farms within the same type of farming. Farmsize only provides a small explanation of these differences. Average farm incomes only convey a limited amount of information. On the one hand it does not show that even with a positive average there can be a large group of farms with low or even negative incomes. On the other hand the strong fluctuations of incomes and the strong changes in the relative income position of farms stress the importance of looking at a long year average to draw meaningful conclusions over the level of income and the standard of living of individual farmers.

The availability of information on off-farm income is still limited, especially in the FADN framework, but there are clear indications that the importance of off-farm income is increasing. Off-farm income is more stable than farm income and thus provides a cushion for farm income fluctuations. Also, off-farm assets are essential in understanding farm behaviour and their ability to cope with cri-

ses. Therefore it is not possible to predict with current datasets whether a crisis will possibly lead to bankruptcy or whether plenty of resources are available to absorb a shock.

The analyses also show that there are large differences in the shortfall risk of farms. Simulated crises show that farms in North-Western Europe have a much higher shortfall risk due to the structure of farming. Small margins make it much more difficult to absorb a shock in the short term. As they are integrated in capital markets, they have the possibility to borrow more in times of crisis, backed by assets or future earnings. The case descriptions show the market response to certain events increases the fluctuations. The market response after the swine fever outbreak led to a strong increase in production due to temporary higher prices (due to a reduced supply) and therefore to a collapse of prices and farm incomes.

Although FADN data can clearly show the impact of factors such as heavy rainfall and classical swine fever on farm incomes, a clear distinction between normal volatility and income crises due to an external event is difficult to make. FADN data is an aggregation of all events that happened during a year on the farm. Normal fluctuations are strong and if a strong effect occurs it requires further information to establish whether this was due to external crises such as heavy rainfall, or that it was due to other circumstances such as bad management, or illness of the farmer.

Discussion on the use of FADN data

If the European Union moves towards systems of income stabilisation and (crisis) risk management, the question arises if the FADN could play a role to monitor stabilisation programmes. Our analysis shows that the FADN could be beneficial in a number of ways:

FADN is a useful and established tool to monitor income and situations of low farm income; however, it is criticised for not providing information on non-farm income and household income (Court of Auditors, 2002). Due to the lack of information on non-farm resources it is also not easy to predict what will happen on a farm after a crisis.

FADN is a good tool, as our analysis showed, to monitor normal business risk and to assess the effect of event-driven crisis risk on the viability of farms. It also makes it possible to monitor if stabilisation-programs are effective; FADN is a good tool to check the payments of national and regional authorities in relation to regulations on state aid.

However, the FADN in its current state does not seem to be a perfect tool to assess the need for crisis-risk management actions by government. There are a number of reasons for this.

The analysis in this report shows large differences in business risk and large variability in year-to-year income at farm level. This means that a low income or a large drop in income is often not the effect of an event-driven crisis-risk. In other words: an event-driven income crisis will lead to a drop in income but many drops in income are not due to event-driven crisis risks. To improve the usefulness of the FADN for this type of data analyses it is suggested to add a variable in the data per farm per year to record if a farm experienced a crisis-event (with a list of pre-defined codes);

The analysis shows that the main problems of event-driven crises are often not the direct effects (e.g. stamping out animals due to a contagious disease like classical swine fever) but the effects due to the market response that changes the business cycle (Mangen and Burell, 2003). It is especially these effects that will show up in FADN data:

- Several event-driven crises affect only a small number of farmers (sometimes this is even true for crises with large effects in market response) and this does not show up in the FADN as this is not representative for small samples. Examples include avian influenza in the Netherlands and heavy snowfall in a tree-nursery area in the Netherlands;
- It takes on average about 2 years before FADN data are available at EU-27 level in Brussels. This is far too late, if it has to trigger actions of authorities to deal with a crisis. However it can be used as a check or for ex-post analysis;
- In case income-stabilisation programmes would be targeted on yield or revenue (yield x price) risk, production (harvest) and price statistics would be more beneficial than FADN data. They are faster and work with standard definitions. In the FADN data yields for many products are not or not very well recorded. Partly this is due to the high (and increasing) heterogeneity of products and partly due to the fact that in many countries data are taken from bookkeeping data for tax purposes (where yield information is not very important).

14.3 Recommendations

Related to these conclusions some questions arise. For instance:

- Do the stronger (growing) fluctuations of incomes of farmers favour a sound structural development in the sector? (in fact do they favour the continuation of well organised farms with a reasonable scale of production);
- Do farmers (as an individual entrepreneur or as a group organised in co-operatives, including co-operative banks and assurance companies) have enough tools to manage and maintain their farms in insecure periods? (in fact are farmers and co-operatives strong enough to survive in a more competitive world);
- Are the stronger fluctuations of incomes of farmers a reason for (new) policy instruments of the European Union and or national/regional governments?
- Do governments have a (co)responsibility to stimulate farmers to manage their farms in an appropriate way to overcome insecure periods?

Such questions arise during a period in which the government (in fact the EU) is in a process of reforming the CAP, with its instruments to stabilise markets of major products, and the introduction of decoupled direct payments under conditions (cross compliance) for the production methods.

In such a period of transition, farmers are looking for new directions in the future for their farm. In this process of adjusting their farm, they will recognise that they have to deal with uncertainties and risks, but at the same time some of these necessary innovations in the sector may not succeed if the uncertainties and risks are too large. In such circumstances the sector will not apply new methods of production and will lose, in the long run, their competitiveness in comparison to other suppliers on the international markets.

Such and other questions related to the actual position of the farm sector in a changing world may stimulate policy makers and others to be curious for additional analyses and more detailed research on these subjects. The results in this report may constitute a basis for those analyses and research.

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Appendix 1

Figures

Figure 4.2 **Fluctuations in average farms in relation to farm size (ESU) and farm income (x €1,000)**

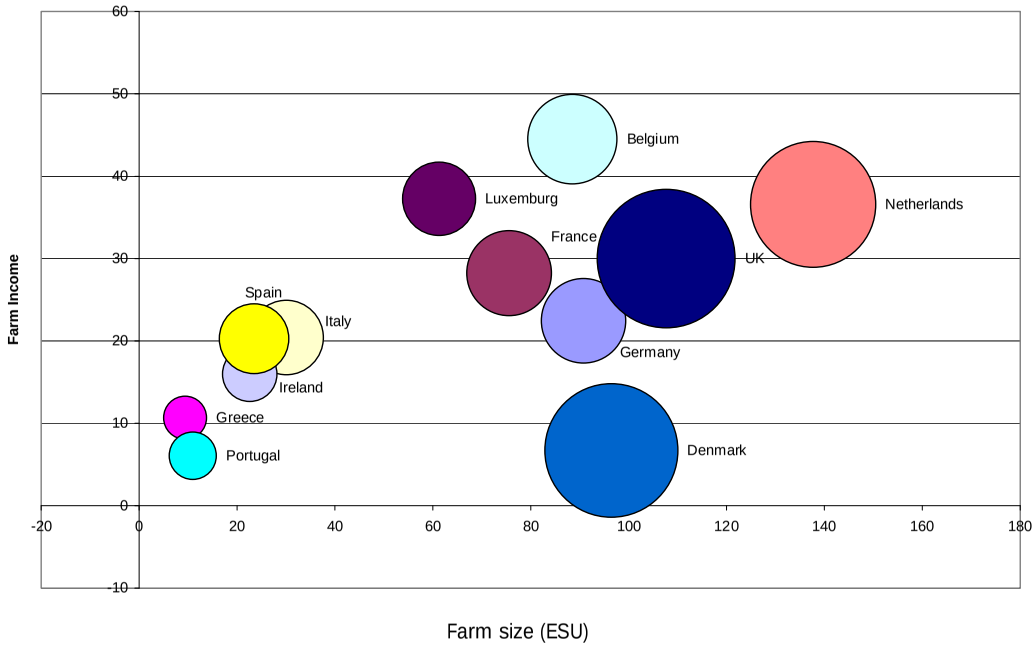


Figure 6.1 **Average family farm income (x € 1,000) of specialised horticulture farms per country per year**

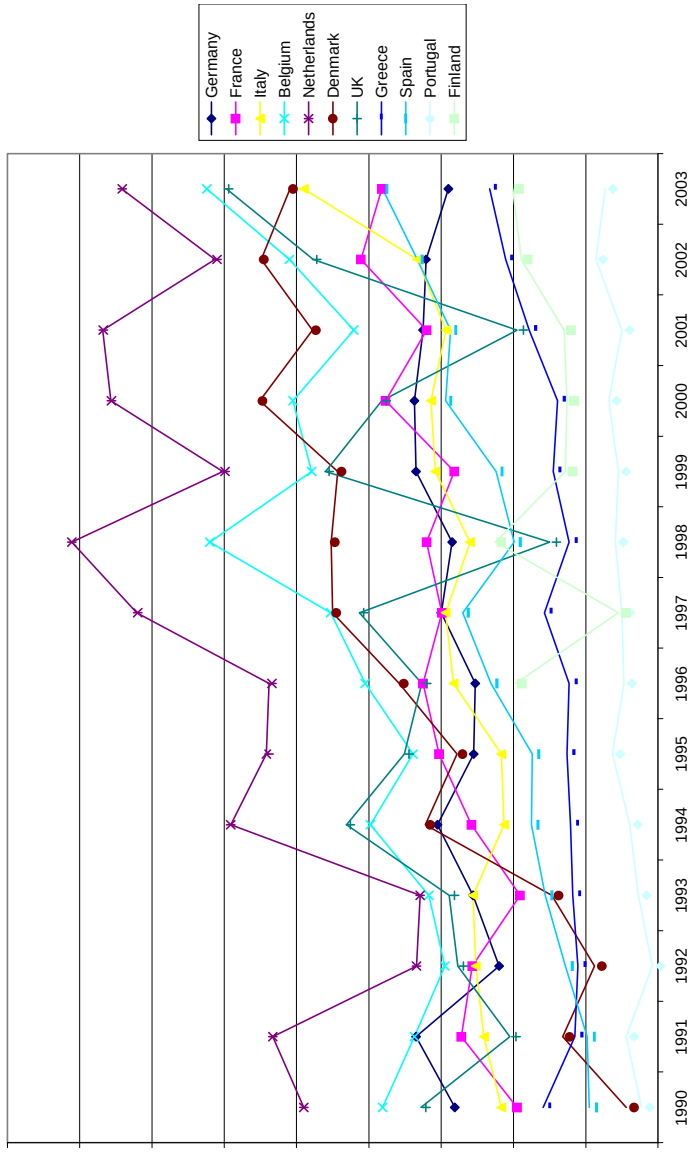


Figure 6.2 **Fluctuations in average farms in relation to farm size (ESU) and farm income (x €1,000)**

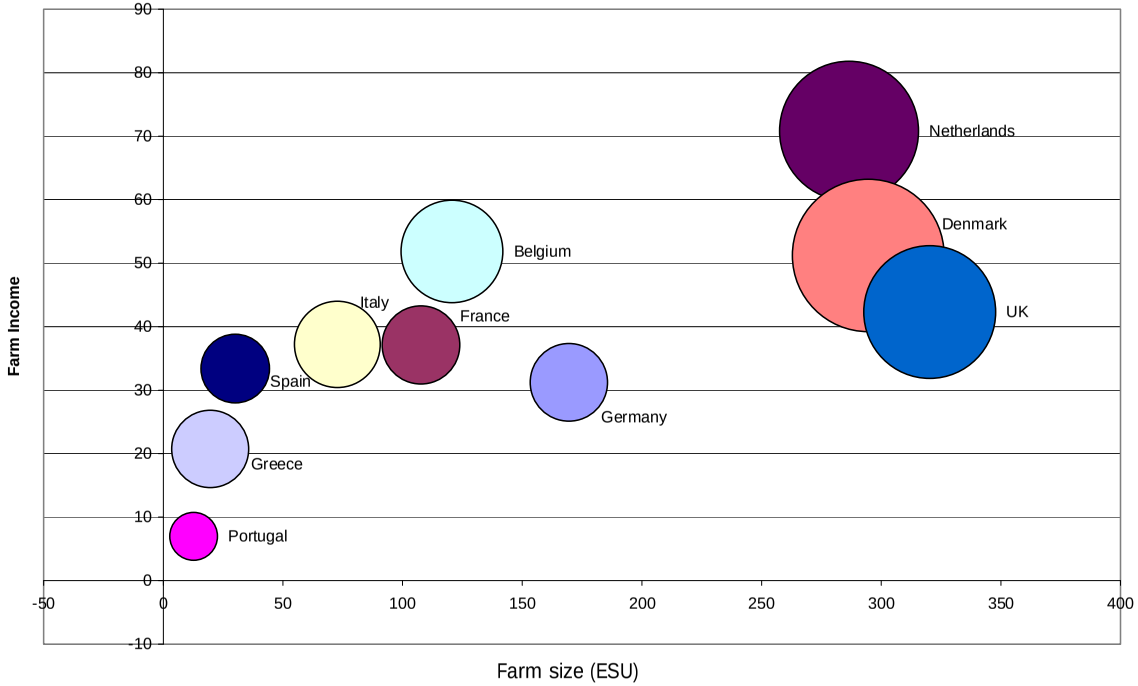
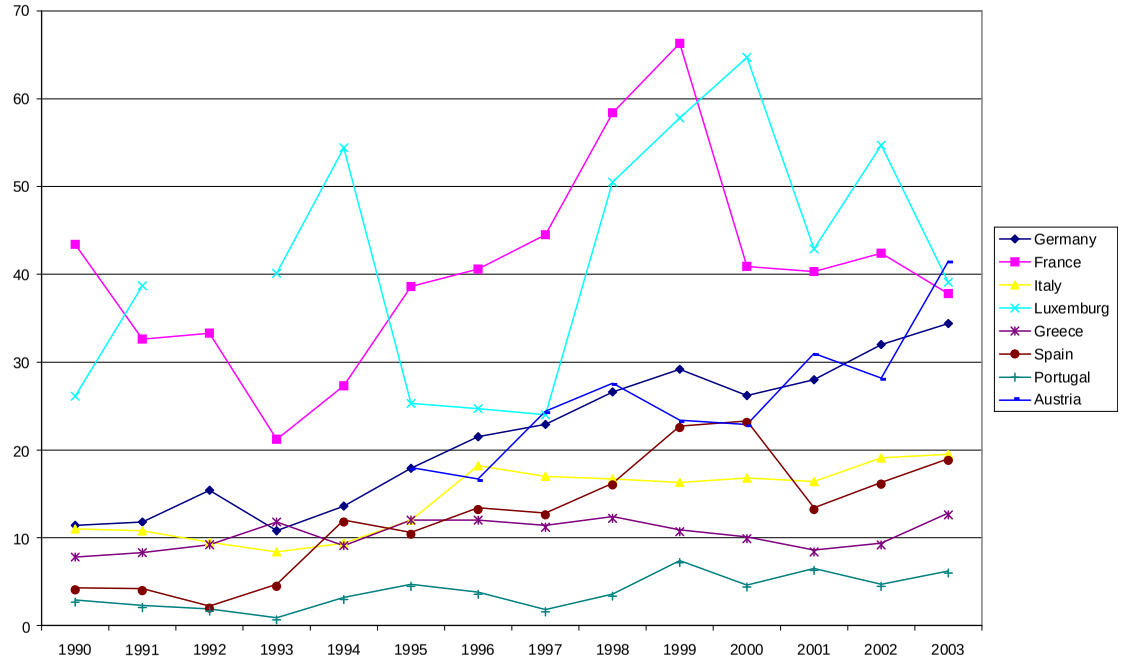


Figure 6.6 **Financial robustness of farms in horticulture after an external shock**

Figure 7.1 **Average family farm income (x €1,000) of specialised wine farms per country per year**



Figuur 7.5 **Financial robustness of wine farms after an external shock**

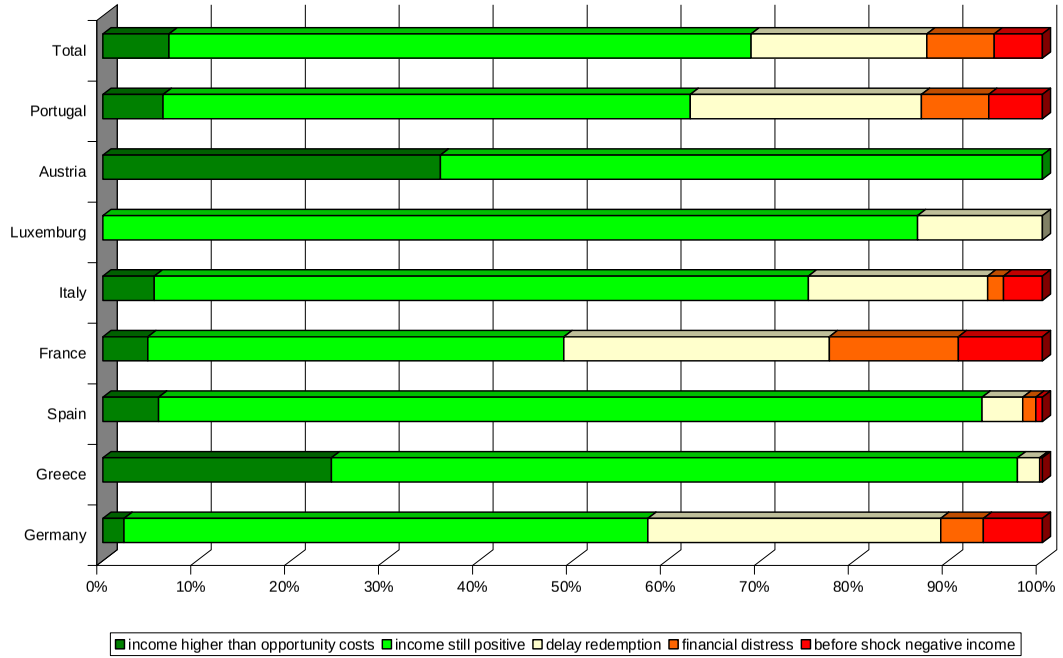


Figure 8.1 **Average family farm income (x €1,000) of other permanent crop farms per country per year**

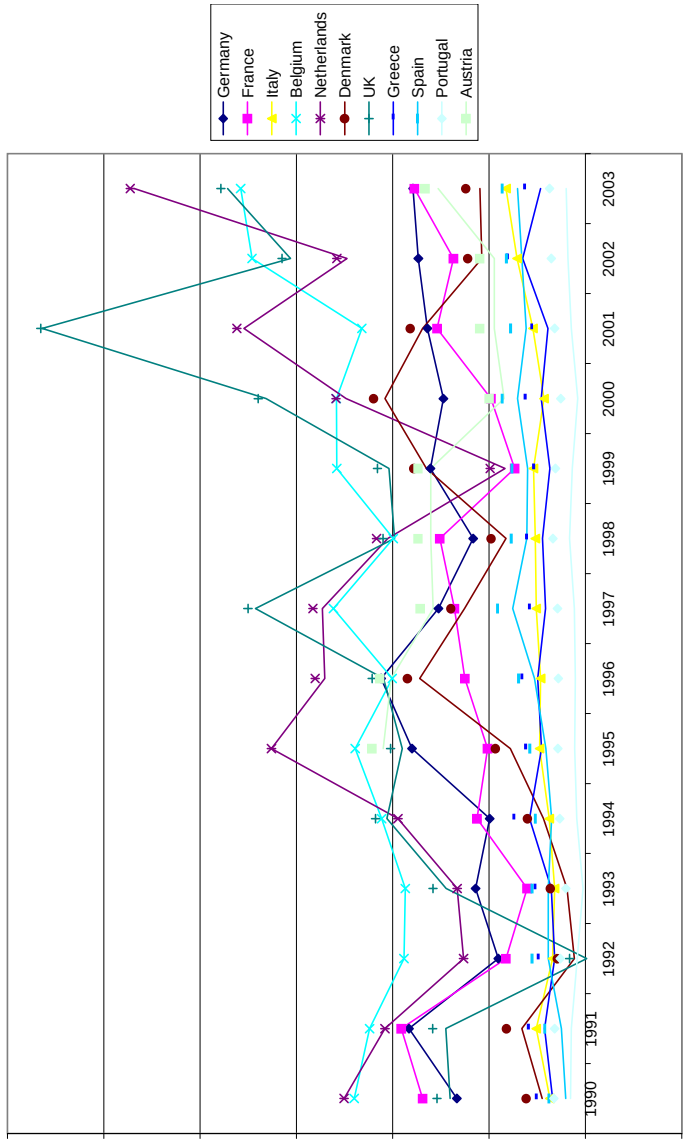


Figure 8.2 **Average family farm income (x €1,000) of specialised fruit farms per country per year**

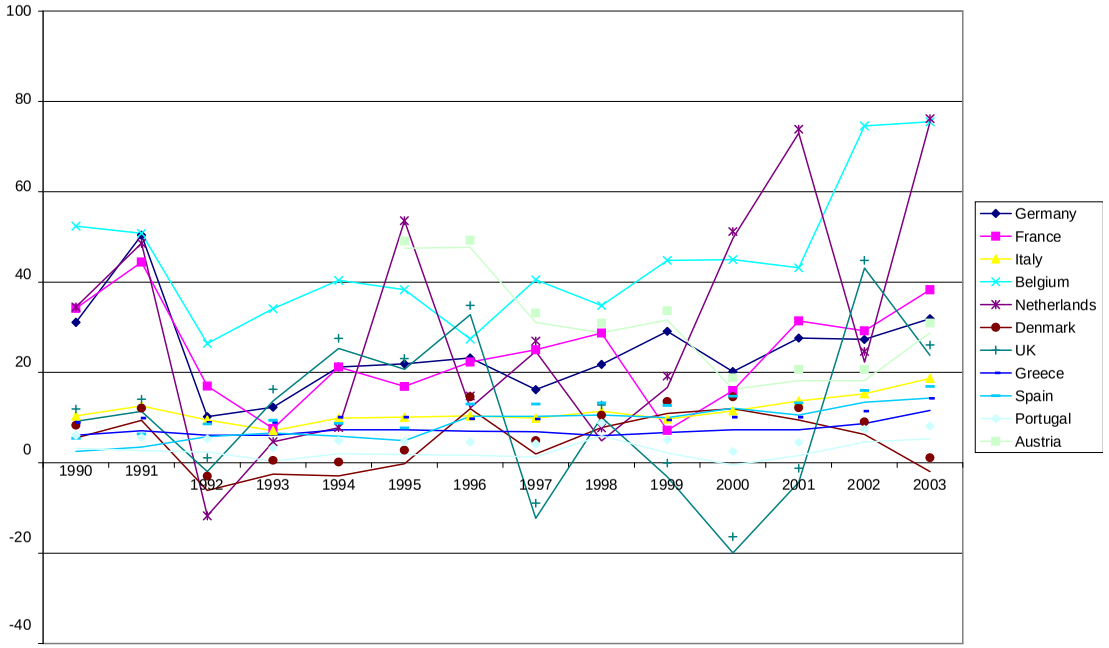


Figure 8.3 **Fluctuations in average farm income in relation to farm size (ESU) and farm income (x €1,000)**

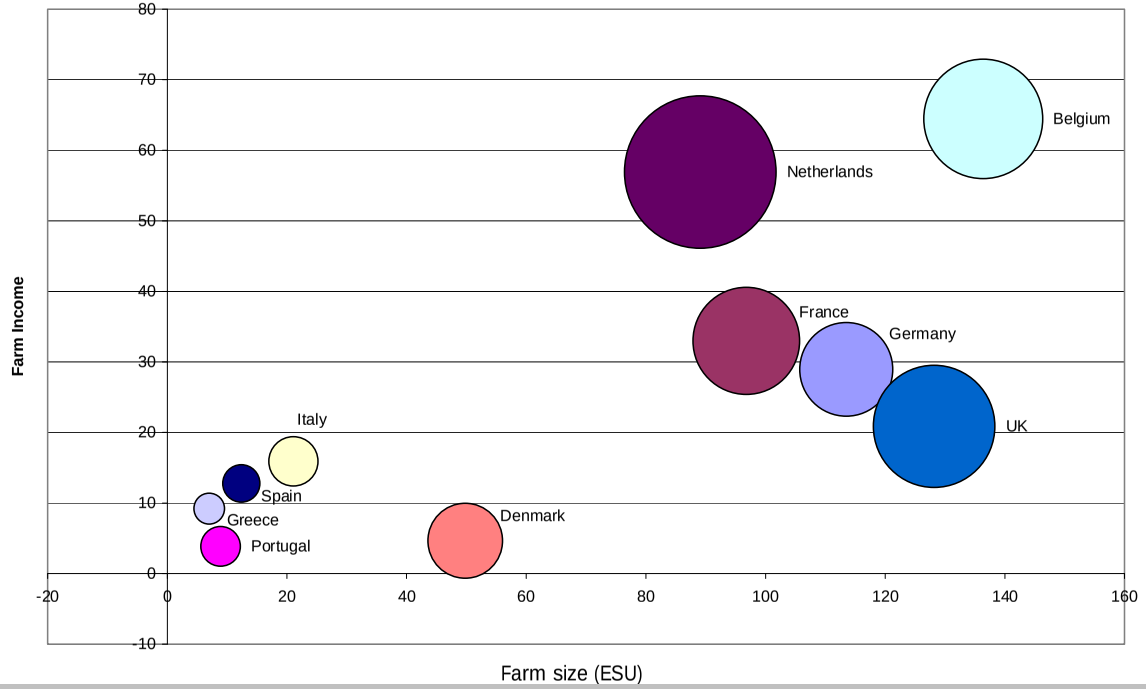


Figure 8.4 **Average family farm income of specialised olive farms per country per year**

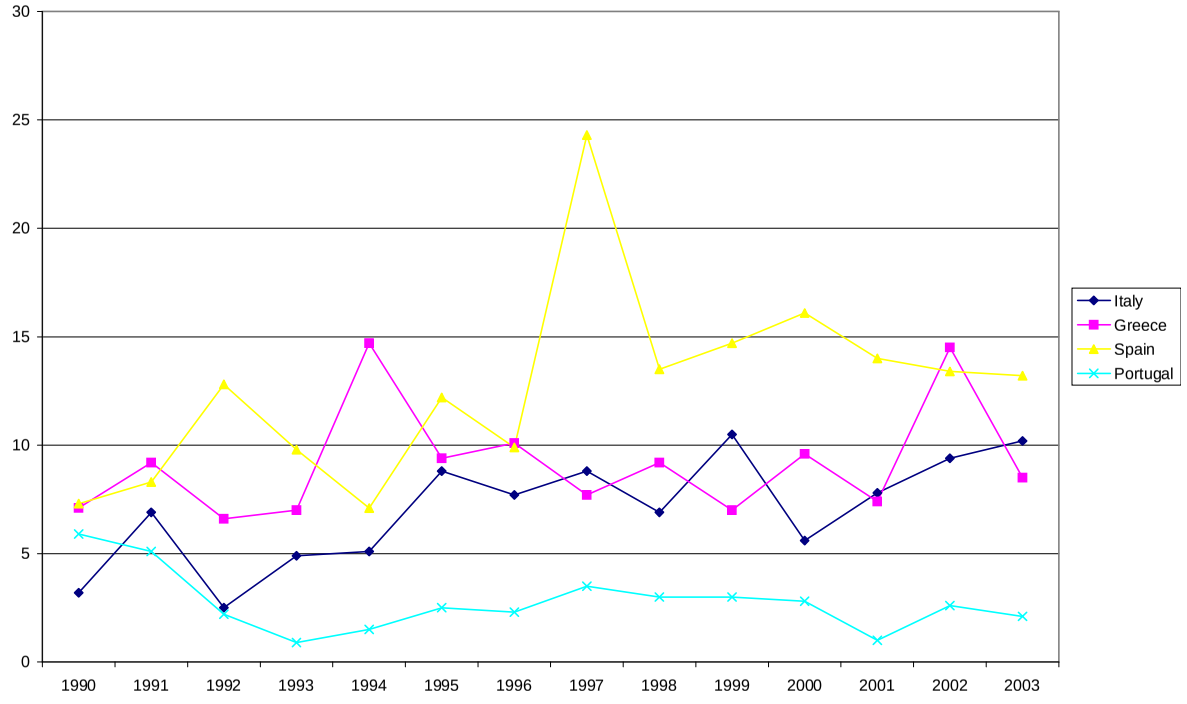


Figure 8.7 **Financial robustness of permanent crop farms after an external shock**

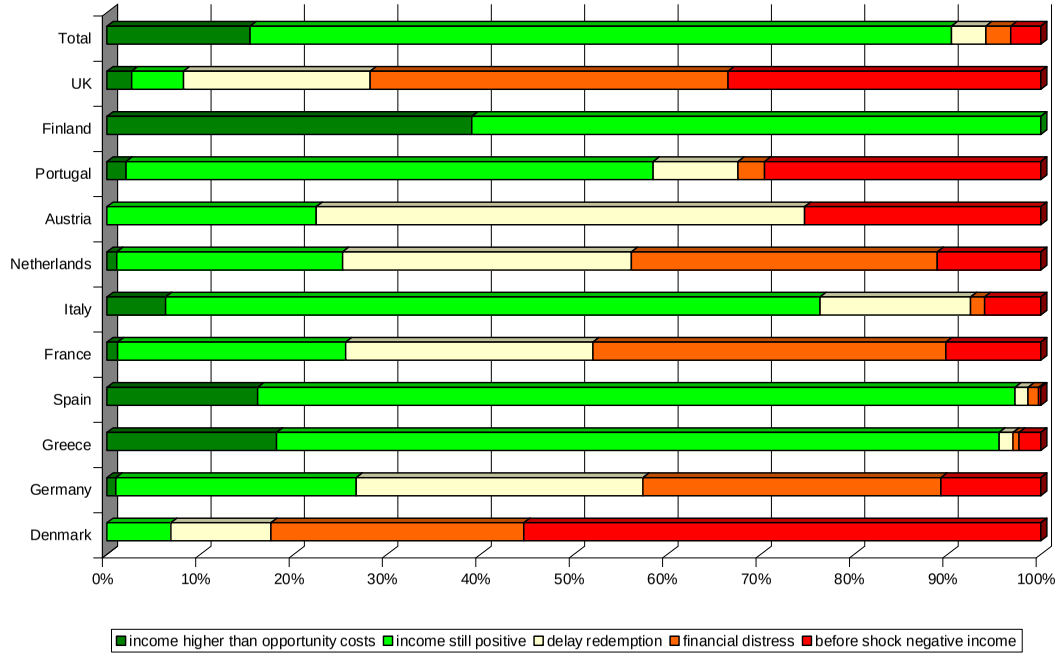


Figure 9.1 **Average family farm income (x €1,000) of specialised dairy farms per country per year**

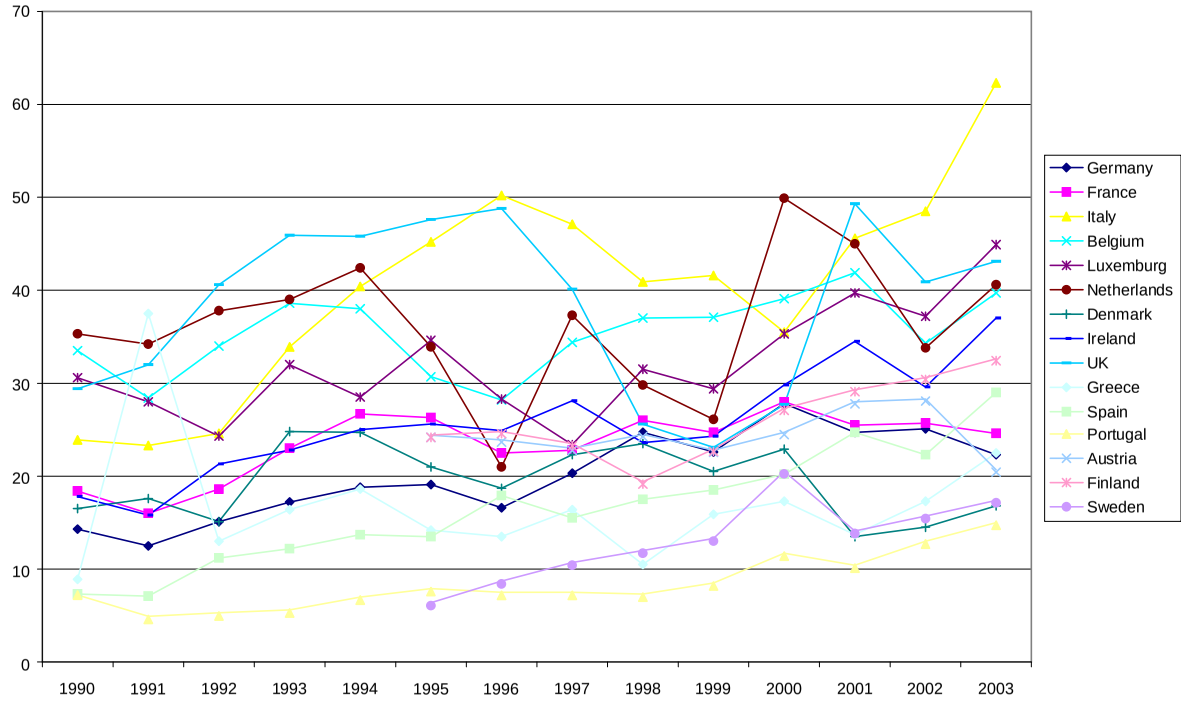


Figure 9.2 **Fluctuations in average farm income in relation to size of farm (ESU) and farm income (x €1,000)**

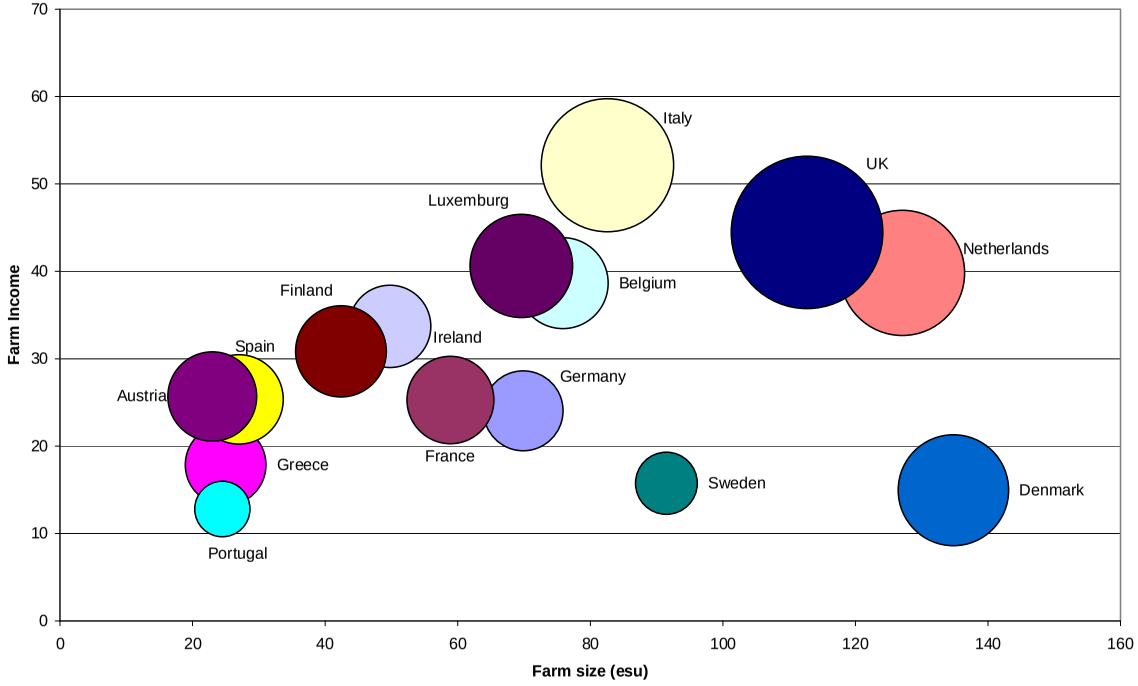


Figure 9.6 **Financial robustness of dairy farms after an external shock**

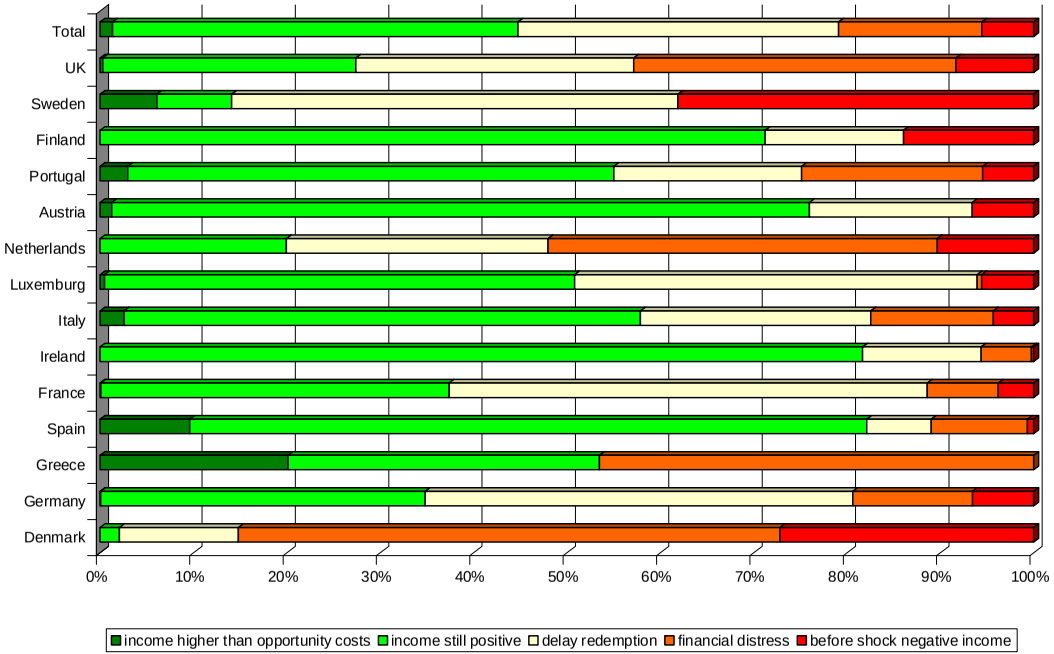
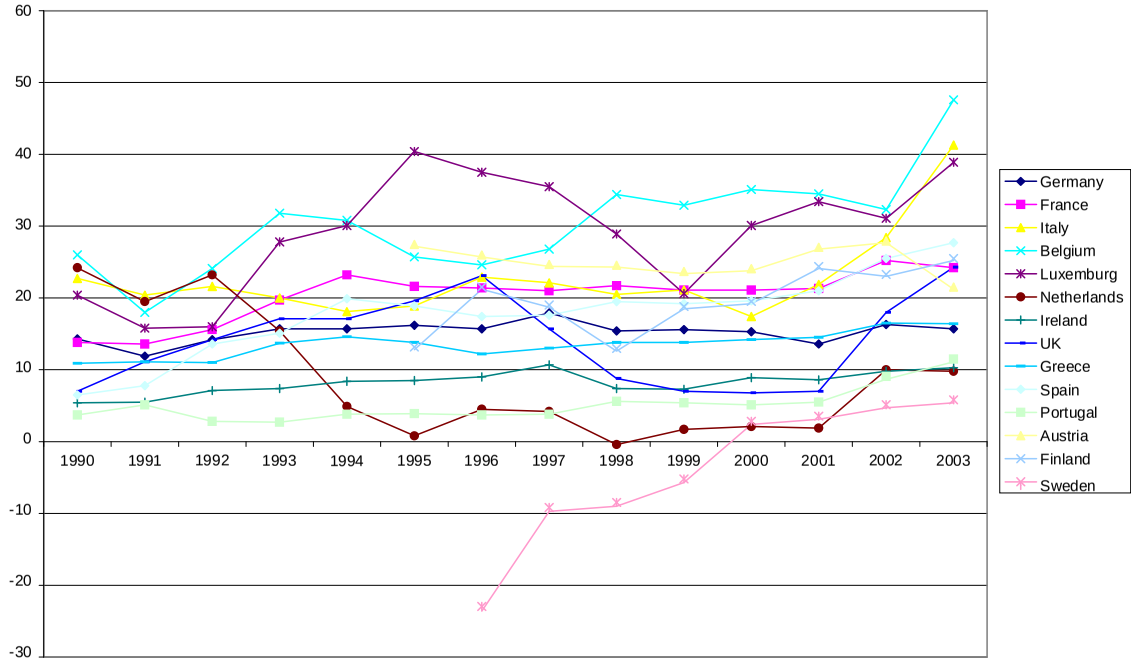


Figure 10.1 **Volatility of family farm income (in euros) on specialised grazing livestock farms (1990-2003)**



Source: FADN-CCE-DG Agri; adaptation by LEI

Figure 10.2 **Fluctuations in average farm income in relation to size of farm (ESU) and farm income (x €1,000)**

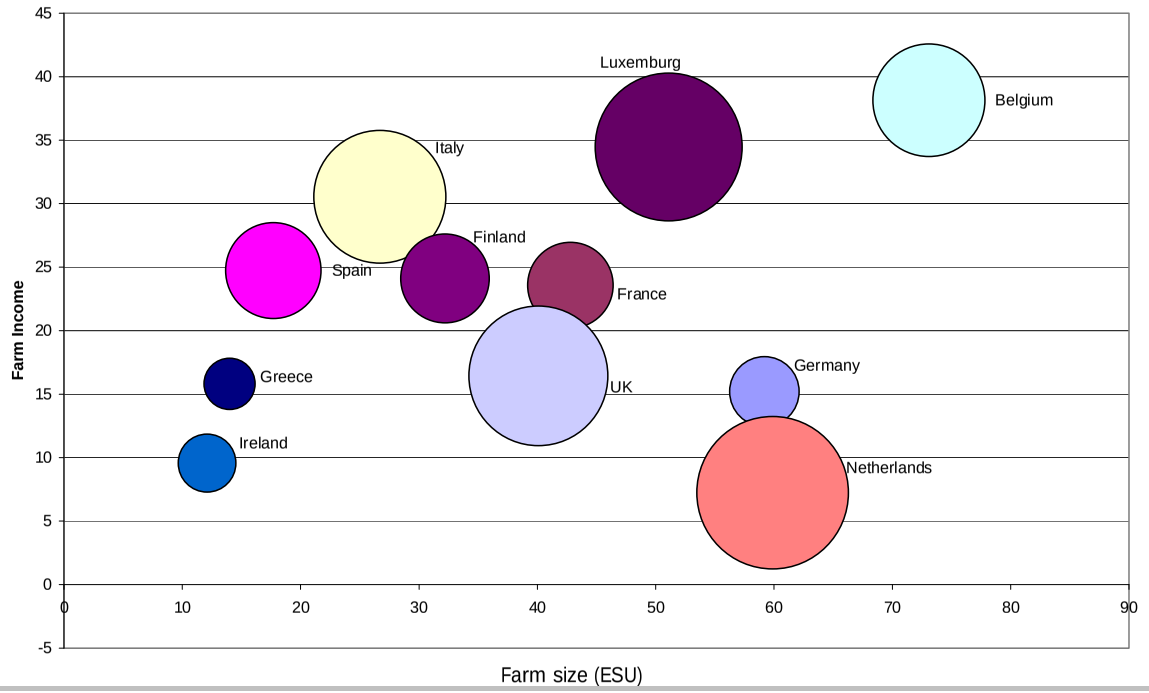


Figure 10.5 **Financial robustness of grazing livestock farms after an external shock**

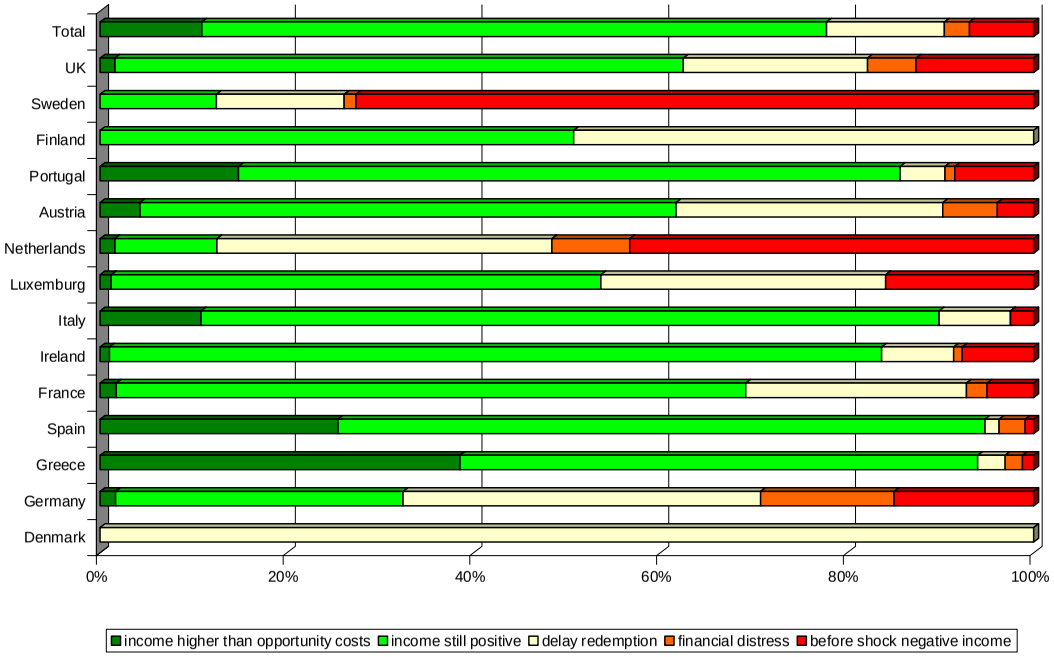


Figure 11.1 **Average family farm income (x €1,000) of specialised granivore farms per country per year**

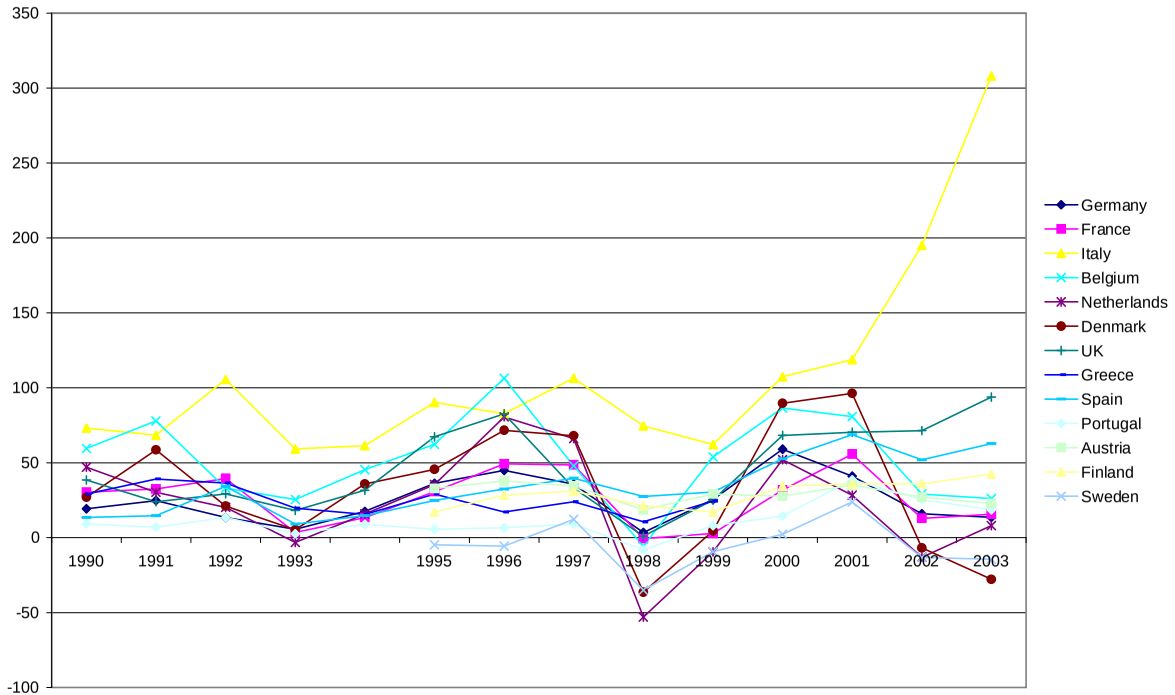


Figure 11.2 **Average family farm income (x €1,000) of specialised pig farms per country per year**

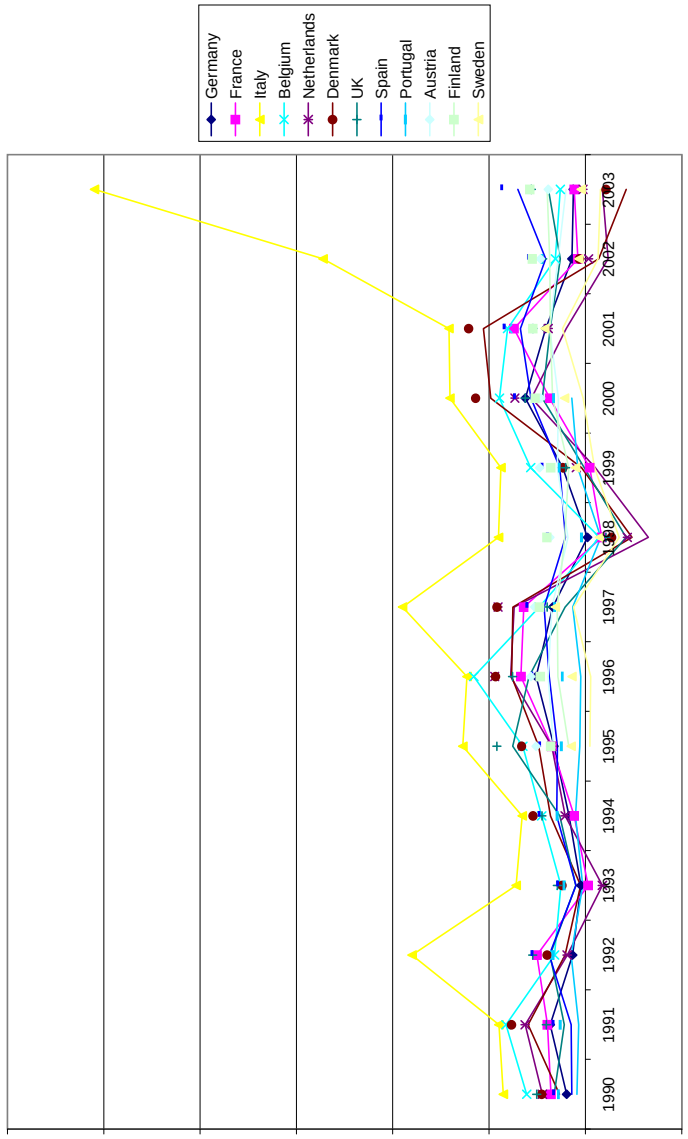


Figure 11.3 **Fluctuations in average farm income in relation to size of farm (ESU) and farm income (x €1,000)**

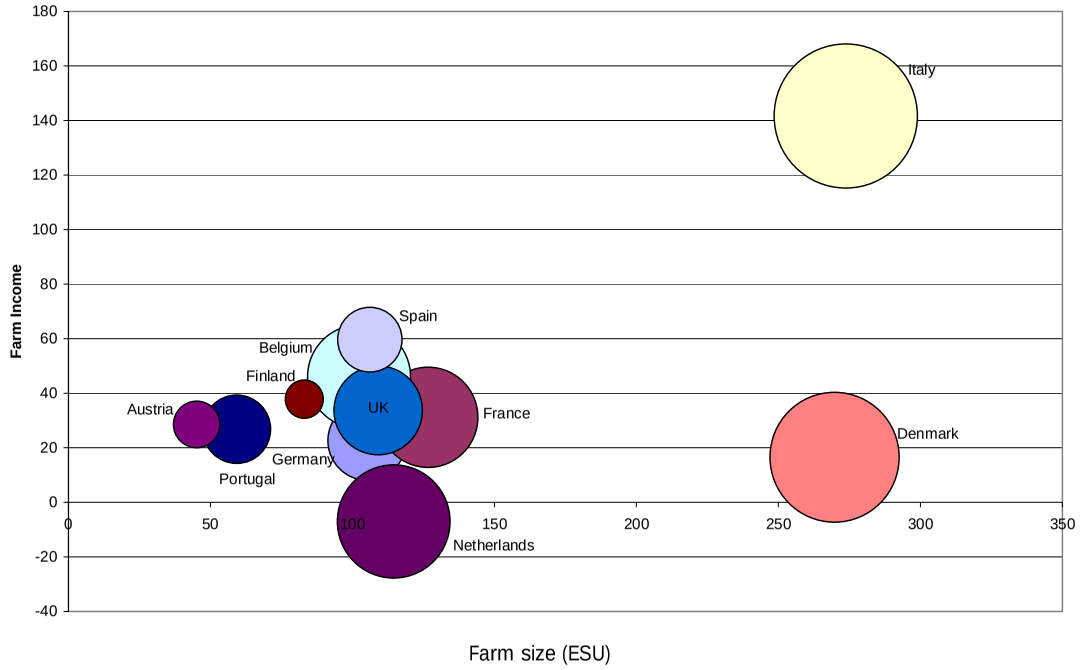


Figure 11.6 **Financial robustness of intensive livestock farms after an external shock**

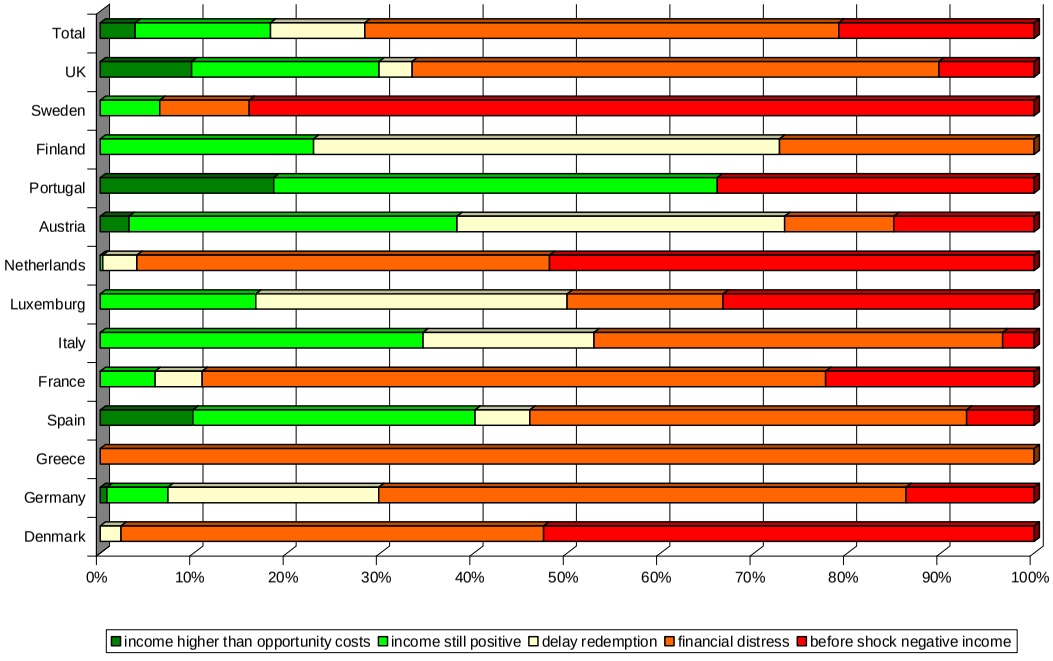


Figure 12.1 **Average family farm income (x €1,000) of mixed farms per country per year**

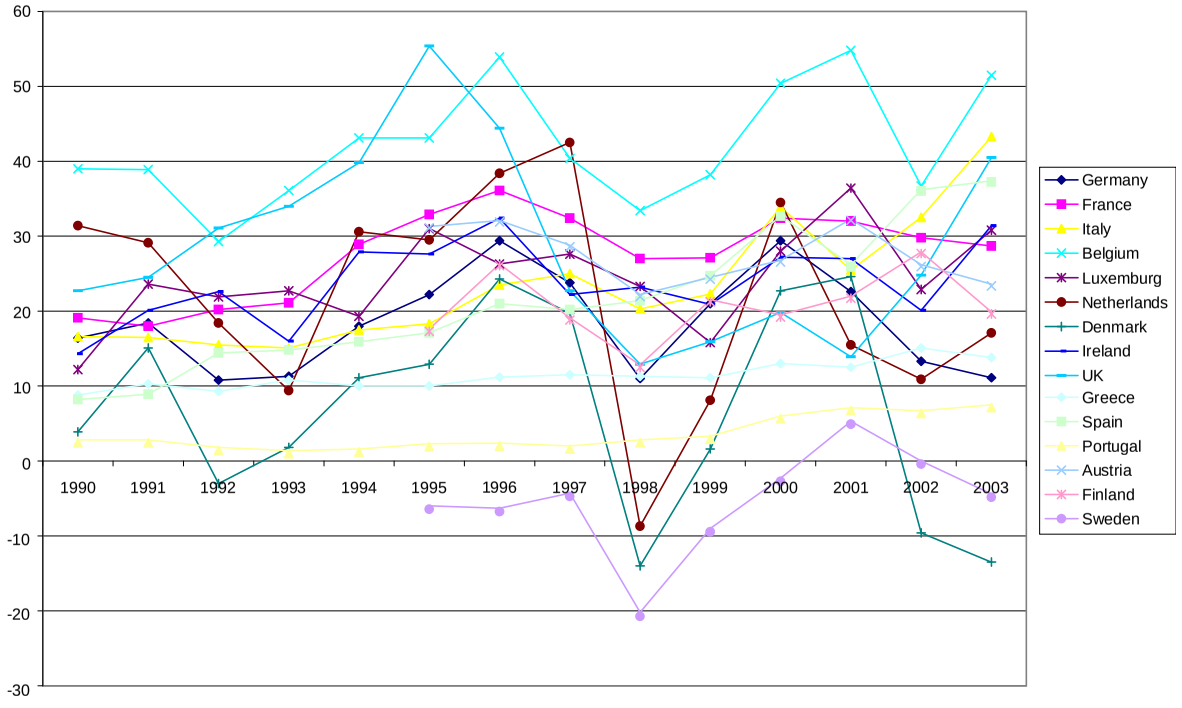


Figure 12.2 **Fluctuations in average farm income in relation to size of farm (ESU) and farm income (x €1,000)**

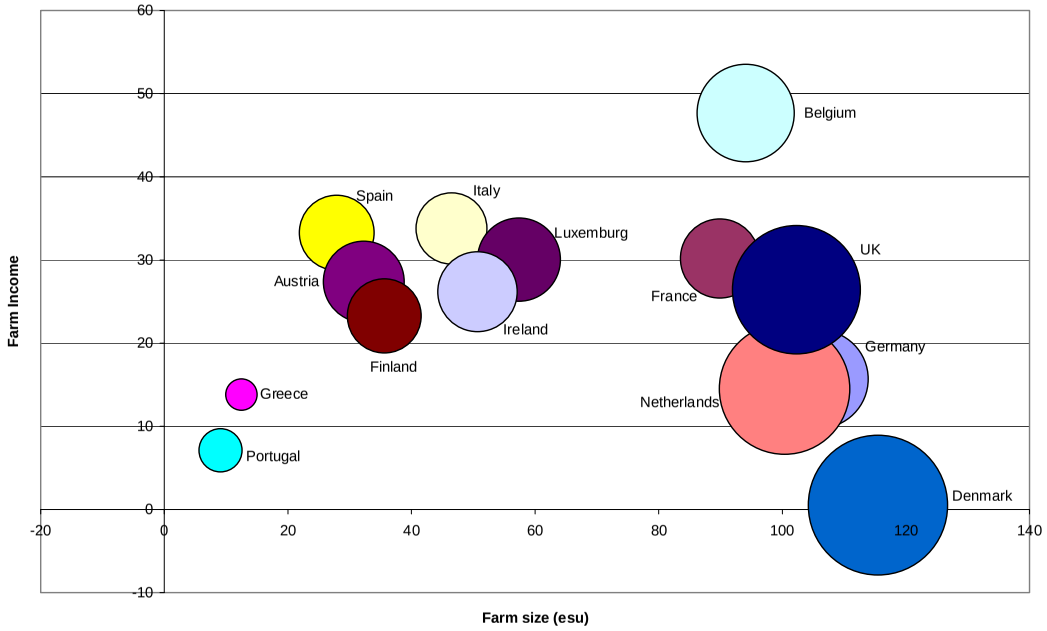
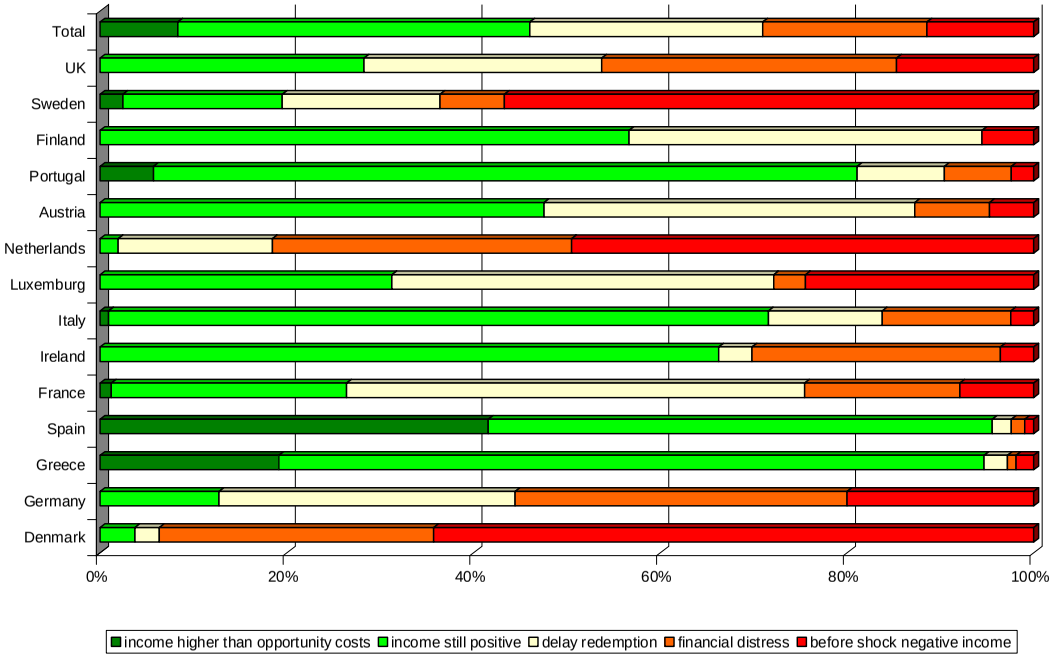


Figure 12.5 **Financial robustness of mixed farms after an external shock**



Appendix 2

Tables A

Table 4.3	Average farm income per country per year (x €1,000)														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	15.0	15.3	13.9	14.5	18.4	21.5	22.7	23.5	19.9	23.4	27.7	25.6	20.1	21.6	3.6
France	21.3	19.7	20.3	20.6	26.5	29.1	30.5	29.7	30.4	29.6	28.7	27.9	28.7	28.1	2.7
Italy	11.1	12.5	10.9	10.5	11.1	13.9	14.1	14.1	13.4	14.2	14.1	15.0	19.8	26.4	4.9
Belgium	36.4	34.4	30.1	34.4	38.8	36.6	42.4	37.8	35.6	39.1	47.2	47.1	37.6	48.8	2.4
Luxemburg	27.1	27.9	29.2	31.7	31.7	33.7	29.0	25.8	31.7	29.5	36.7	38.6	35.1	38.1	2.4
Netherlands	38.6	34.5	27.6	25.6	40.1	37.3	33.9	42.9	25.1	21.6	41.9	42.2	27.6	39.9	0.7
Denmark	4.9	8.9	0.5	6.0	13.5	15.3	17.9	17.0	-1.0	6.4	21.8	18.1	0.8	1.2	2.9
Ireland	10.2	9.8	12.4	12.7	14.1	14.3	14.3	15.7	12.5	12.4	14.7	15.5	15.1	17.3	3.3
UK	21.3	23.2	27.9	31.6	38.5	44.7	40.6	27.3	18.1	18.3	20.1	22.1	28.6	39.3	1.8
Greece	7.7	9.2	7.4	8.3	10.3	9.6	9.3	9.0	9.3	8.6	9.6	9.3	12.1	10.6	2.3
Spain	6.0	6.6	10.3	11.2	13.4	12.7	16.0	17.4	15.9	16.6	19.8	18.4	19.7	22.7	8.5
Portugal	3.5	3.4	2.3	1.4	2.9	3.2	3.0	2.6	3.5	4.1	4.4	5.4	6.0	6.8	6.4
Austria						28.0	28.0	26.0	24.4	24.7	24.9	28.8	27.0	23.5	
Finland						20.6	22.7	20.1	16.1	18.4	22.2	22.7	24.4	22.7	
Sweden						2.0	3.3	5.2	-1.9	1.9	6.2	7.6	6.7		

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.1	Average family farm income (in €1,000) of specialised field crops farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	13.5	15.4	12.8	13.9	19.8	25.8	26.0	28.4	20.7	25.9	25.4	30.5	16.5	27.3	5.4
France	19.8	19.4	18.2	21.1	28.7	31.2	34.8	32.3	30.8	27.4	26.3	22.8	25.8	27.3	2.6
Italy	8.6	10.1	8.3	8.4	8.6	11.3	10.0	9.6	9.3	10.3	11.4	10.7	12.4	19.1	4.1
Belgium	33.3	32.2	27.6	36.2	41.7	39.3	33.6	41.8	47.7	32.7	41.1	43.7	37.4	56.1	3.6
Netherlands	36.7	24.1	6.2	20.9	64.0	47.9	22.3	35.9	45.3	15.9	14.8	43.1	17.3	37.6	3.5
Denmark	-2.2	-3.2	-7.1	-2.6	2.8	6.2	4.3	3.4	-3.0	-0.1	8.4	3.9	-2.0	3.5	Inc
UK	29.2	30.7	34.1	39.9	62.3	72.3	50.2	29.4	27.0	25.5	24.0	15.9	27.1	42.4	-0.9
Greece	7.5	9.0	7.1	8.0	8.4	8.6	7.5	8.0	8.2	7.7	8.2	8.8	9.2	8.8	1.2
Spain	5.6	5.9	8.4	12.2	16.1	12.5	18.9	17.5	16.6	17.1	20.8	17.8	18.8	20.8	10.1
Portugal	3.4	3.1	2.1	1.1	2.7	2.6	2.5	2.0	3.1	3.1	4.3	4.3	4.3	4.8	4.1
Austria						33.4	33.9	29.0	26.8	27.2	26.4	28.3	25.9	28.1	
Finland						15.2	18.4	15.3	11.0	12.2	16.5	14.1	15.3	11.9	
Sweden						6.2	10.0	6.0	-2.6	-1.0	-0.9	3.5	3.3	6.1	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.2	Average family farm income of specialised cereal farms per country per year (x €1,000)														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	2.4	2.4	3.1	6.1	12.5	29.2	23.3	30.5	17.6	26.9	19.9	26.4	12.0	21.1	20.1
France	15.7	18.7	16.0	19.3	27.2	29.9	33.1	30.7	27.5	24.3	24.3	16.7	22.3	22.3	1.8
Italy	6.4	7.4	6.4	8.1	8.2	11.6	8.7	7.8	6.9	7.4	6.4	7.5	7.9	15.5	4.3
Denmark	-4.4	-3.6	-8.2	-3.7	-0.8	3.7	1.4	0.8	-5.3	-1.9	5.3	1.0	-3.3	1.0	Inc.
Ireland	16.9	25.8	23.1	19.0	27.5	35.8	24.5	16.4	18.7	34.7	22.0	21.7	18.5	30.2	0.7
UK	17.1	22.0	35.1	34.1	49.6	63.2	57.4	29.4	20.0	31.4	20.6	12.2	24.6	36.3	-0.1
Greece	5.5	6.4	4.5	6.0	4.8	6.1	4.3	4.0	4.0	3.5	3.8	4.7	3.8	4.0	-2.7
Spain	4.7	4.8	7.8	9.4	15.4	11.5	17.6	16.0	15.5	16.4	18.2	15.7	15.0	18.5	11.0
Portugal	4.2	3.7	1.5	4.2	10.2	8.3	8.5	3.7	5.1	7.7	10.0	9.4	7.5	10.4	11.3
Austria						26.0	28.3	21.8	19.9	20.3	20.7	22.4	20.2	23.2	
Finland						14.2	16.2	12.1	6.7	5.9	16.2	11.7	13.2	10.5	
Sweden						5.7	10.9	7.5	-4.0	-1.1	-2.2	-0.7	0.3	4.6	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 6.1	Average family farm income (x €1,000) of specialised horticulture farms per country per year														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	% trend
Germany	28.1	33.5	22.0	25.6	30.5	25.5	25.3	30.0	28.5	33.5	33.7	32.5	32.1	29.0	1.0
France	19.5	27.2	25.7	19.1	25.8	30.3	32.5	29.9	32.0	28.2	37.7	32.0	41.1	38.2	4.0
Italy	21.7	24.1	25.2	25.6	21.3	21.7	28.3	29.4	26.0	30.8	31.4	29.3	33.3	49.0	4.2
Belgium	38.1	33.7	29.5	31.7	39.8	33.9	40.5	45.3	62.0	47.9	50.5	42.1	51.0	62.4	4.0
Netherlands	49.0	53.3	33.4	32.9	59.1	54.2	53.8	72.1	81.1	60.2	75.7	76.8	61.3	74.2	4.2
Denmark	4.4	13.2	8.8	14.7	32.2	27.8	35.8	45.0	45.2	44.3	55.1	47.8	54.9	50.9	17.4
UK	32.8	20.5	27.7	28.9	43.1	35.1	32.7	41.3	15.0	46.0	38.2	19.5	47.7	59.7	4.2
Greece	15.9	11.5	11.1	11.8	12.1	12.6	12.3	15.7	12.3	14.5	13.9	17.8	21.1	23.3	4.5
Spain	9.5	9.8	12.8	15.6	17.5	17.4	23.1	27.0	19.9	22.4	29.4	28.7	33.3	38.1	10.9
Portugal	2.3	4.4	0.8	2.7	3.9	6.3	4.7	5.0	5.9	5.5	6.8	5.0	8.6	7.3	9.8
Finland							19.7	5.5	22.5	12.8	12.6	13.0	18.9	20.1	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 7.1	Average family farm income (x €1,000) of specialised wine farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	11.4	11.8	15.4	10.8	13.6	17.9	21.5	22.9	26.6	29.2	26.2	28.0	32.0	34.4	8.5
France	43.4	32.6	33.3	21.2	27.3	38.6	40.6	44.5	58.4	66.3	40.9	40.3	42.4	37.8	0.9
Italy	11.0	10.8	9.5	8.4	9.4	12.0	18.2	17.0	16.7	16.3	16.8	16.4	19.1	19.5	5.3
Luxemburg	26.1	38.7		40.1	54.4	25.3	24.7	24.0	50.5	57.8	64.7	42.9	54.7	39.1	3.1
Greece	7.8	8.3	9.2	11.8	9.1	12.0	12.0	11.4	12.4	10.9	10.1	8.6	9.4	12.8	1.8
Spain	4.3	4.2	2.2	4.7	12.0	10.6	13.4	12.8	16.2	22.7	23.3	13.4	16.3	19.0	14.8
Portugal	2.9	2.3	1.9	0.9	3.2	4.7	3.8	1.8	3.6	7.4	4.6	6.5	4.7	6.2	8.5
Austria						18.0	16.7	24.4	27.6	23.4	22.9	31.0	28.2	41.5	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 8.1	Average family farm income (x €1,000) of other permanent crop farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	26.7	36.6	18.1	22.8	19.9	36.0	42.4	30.5	23.3	32.2	29.5	32.8	34.7	35.8	2.2
France	33.8	38.2	16.5	12.1	22.5	20.3	25.0	27.2	30.2	14.7	19.6	30.8	27.4	35.5	0.5
Italy	7.4	10.2	6.8	6.4	7.5	9.5	9.3	10.2	10.4	10.8	8.6	10.9	14.2	16.5	5.0
Belgium	48.0	44.8	37.7	37.4	42.3	47.8	40.1	52.3	39.9	51.6	51.7	46.4	69.2	71.6	3.3
Netherlands	50.1	41.6	25.3	26.6	38.9	65.2	54.1	54.6	41.0	16.7	49.7	70.9	49.5	93.7	5.6
Denmark	9.0	13.2	2.3	3.8	8.7	15.6	34.4	25.1	16.5	33.0	41.6	33.8	21.5	21.9	11.0
UK	28.1	29.0	-0.3	28.9	41.2	38.0	41.9	68.5	39.6	40.8	66.3	112.8	61.2	74.3	14.4
Greece	6.8	8.5	6.4	7.1	11.6	9.1	9.9	8.3	8.9	7.4	9.2	7.8	13.0	9.3	3.0
Spain	4.1	5.0	7.7	7.7	7.0	8.2	10.6	15.1	12.2	12.0	14.1	12.3	13.2	14.1	8.1
Portugal	3.1	2.9	1.7	0.5	1.8	2.2	2.1	2.3	3.3	2.7	1.6	2.9	3.6	4.0	2.9
Austria						42.0	40.3	31.6	32.1	32.1	16.9	18.9	18.9	30.6	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 8.3	Average family farm income (x €1,000) of specialised fruit farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	31.1	50.4	10.2	12.3	21.2	21.9	23.2	16.2	21.8	29.1	20.2	27.6	27.3	31.9	-0.5
France	34.2	44.4	17.0	7.6	21.2	16.9	22.3	25.0	28.7	7.2	16.0	31.4	29.2	38.3	0.3
Italy	10.4	12.6	9.5	7.1	9.9	10.1	10.4	9.9	11.4	9.7	11.5	13.7	15.3	18.7	3.9
Belgium	52.4	50.8	26.4	34.1	40.4	38.3	27.4	40.5	34.8	44.8	45.0	43.2	74.6	75.5	4.1
Netherlands	34.5	48.6	-11.7	4.7	7.8	53.6	12.2	24.7	4.9	16.7	49.7	73.0	22.3	75.4	9.1
Denmark	5.5	9.4	-6.1	-2.5	-2.9	-0.2	12.0	2.0	7.8	10.9	12.0	9.5	6.3	-1.9	4.6
UK	9.2	11.4	-1.9	13.7	25.3	20.7	32.8	-12.3	10.1	-3.1	-19.9	-4.3	43.1	23.8	12.8
Greece	6.1	7.1	6.1	6.1	7.3	7.3	7.0	6.9	6.0	6.7	7.3	7.3	8.7	11.6	3.6
Spain	2.5	3.5	5.8	6.6	5.9	4.9	10.3	10.3	10.6	10.0	12.1	10.6	13.4	14.3	12.5
Portugal	3.2	2.7	2.4	0.4	2.0	1.8	1.7	1.3	6.0	2.2	-0.5	1.6	4.6	5.3	3.4
Austria						47.5	47.7	31.1	28.8	31.6	16.3	18.2	18.2	28.8	

Source: FADN-CCE-DG Agri; adaptation by LEI

Table 8.8	Average family farm income of specialised olive farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Italy	3.2	6.9	2.5	4.9	5.1	8.8	7.7	8.8	6.9	10.5	5.6	7.8	9.4	10.2	7.3
Greece	7.1	9.2	6.6	7.0	14.7	9.4	10.1	7.7	9.2	7.0	9.6	7.4	14.5	8.5	2.6
Spain	7.3	8.3	12.8	9.8	7.1	12.2	9.9	24.3	13.5	14.7	16.1	14.0	13.4	13.2	3.6
Portugal	5.9	5.1	2.2	0.9	1.5	2.5	2.3	3.5	3.0	3.0	2.8	1.0	2.6	2.1	-8.0

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 9.1	Average family farm income (x €1,000) of specialised dairy farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	14.3	12.5	15.1	17.2	18.8	19.1	16.6	20.3	24.7	22.6	27.8	24.7	25.1	22.3	5.1
France	18.4	16.0	18.6	23.0	26.7	26.3	22.5	22.8	26.0	24.7	28.0	25.5	25.7	24.6	3.3
Italy	23.9	23.3	24.6	33.9	40.4	45.2	50.2	47.1	40.9	41.6	35.5	45.6	48.5	62.3	7.3
Belgium	33.5	28.4	34.0	38.6	38.0	30.7	28.2	34.4	37.0	37.1	39.1	41.9	34.3	39.7	1.7
Luxemburg	30.6	28.0	24.3	32.0	28.5	34.6	28.3	23.4	31.5	29.4	35.3	39.7	37.2	44.9	3.6
Netherlands	35.3	34.2	37.8	39.0	42.4	33.9	21.0	37.3	29.8	26.1	49.9	45.0	33.8	40.6	1.0
Denmark	16.5	17.6	15.1	24.8	24.7	21.0	18.7	22.3	23.5	20.5	22.9	13.5	14.5	16.8	-0.8
Ireland	17.8	15.8	21.3	22.8	25.0	25.6	24.9	28.1	23.6	24.3	29.8	34.5	29.6	37.0	5.7
UK	29.4	32.0	40.6	45.9	45.8	47.6	48.8	40.1	25.6	23.1	27.7	49.3	40.9	43.1	2.5
Greece	8.9		13.0	16.4	18.6	14.2	13.5	16.4	10.5	15.9	17.3	13.7	17.3	22.5	-0.9
Spain	7.3	7.1	11.2	12.2	13.7	13.5	17.9	15.5	17.5	18.5	20.2	24.7	22.3	29.0	10.4
Portugal	7.2	4.9	5.3	5.6	7.0	7.9	7.5	7.5	7.3	8.5	11.7	10.4	13.0	15.0	7.5
Austria						24.4	23.9	23.0	24.5	22.8	24.7	28.0	28.3	20.7	
Finland						24.4	24.8	23.5	19.4	22.9	27.3	29.3	30.6	32.6	
Sweden						6.4	8.7	10.7	12.0	13.3	20.5	14.1	15.7	17.4	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 10.1	Average family farm income (x €1,000) of specialised grazing livestock farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	14.3	11.9	14.2	15.7	15.7	16.2	15.7	17.9	15.4	15.6	15.3	13.6	16.3	15.7	1.1
France	13.8	13.6	15.6	19.7	23.2	21.6	21.4	21.0	21.7	21.1	21.1	21.3	25.2	24.2	4.6
Italy	22.7	20.4	21.6	20.0	18.1	18.9	22.9	22.1	20.5	21.1	17.4	21.9	28.4	41.3	3.2
Belgium	26.0	18.0	24.1	31.8	30.8	25.7	24.6	26.8	34.4	32.9	35.1	34.5	32.3	47.6	4.8
Luxemburg	20.4	15.8	16.0	27.8	30.1	40.4	37.5	35.5	28.9	20.6	30.1	33.4	31.1	38.9	6.4
Netherlands	24.2	19.5	23.2	15.4	4.9	0.8	4.5	4.2	-0.4	1.7	2.1	1.9	10.0	9.8	-9.7
Ireland	5.4	5.5	7.1	7.4	8.4	8.5	9.0	10.7	7.4	7.3	8.9	8.6	9.8	10.3	4.3
UK	7.0	11.1	14.2	17.1	17.1	19.6	23.1	15.7	8.8	7.0	6.8	7.0	18.0	24.3	3.9
Greece	10.9	11.1	11.0	13.7	14.6	13.8	12.2	13.0	13.8	13.8	14.2	14.5	16.5	16.4	3.3
Spain	6.5	7.8	13.6	15.1	19.9	18.9	17.4	17.6	19.5	19.2	19.6	21.0	25.5	27.7	9.3
Portugal	3.7	5.1	2.8	2.7	3.8	3.9	3.7	3.8	5.6	5.4	5.1	5.5	8.7	11.1	7.3
Austria						27.2	25.7	24.4	24.3	23.4	23.8	26.8	27.7	21.2	
Finland						12.8	21.2	18.7	12.6	18.5	19.2	24.1	23.0	25.2	
Sweden							-23.6	-9.7	-9.0	-5.7	2.4	3.1	4.7	5.4	

Source: FADN-CCE-DG Agri; adaptation by LEI

Table 11.1	Average family farm income (x €1,000) of specialised granivore farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	19.3	24.8	13.4	5.5	17.6	36.3	44.9	35.7	3.4	25.5	59.0	41.1	15.9	13.6	1.9
France	30.4	32.5	39.6	3.5	13.5	30.7	49.3	48.6	-0.7	2.8	31.8	55.8	12.9	15.7	-1.8
Italy	73.2	68.4	105.7	59.2	61.4	90.3	82.8	106.5	74.6	62.2	107.4	118.9	195.2	308.1	8.7
Belgium	59.6	77.9	33.1	25.4	45.4	62.3	106.3	47.9	-5.7	53.9	86.6	80.8	29.2	26.1	-2.0
Nether-lands	47.1	30.3	20.3	-3.2	15.8	35.5	80.7	66.1	-53.0	-9.5	52.0	28.3	-13.0	8.0	-12.2
Denmark	27.0	58.6	21.1	5.3	35.9	45.6	71.7	68.0	-36.4	4.5	89.8	96.4	-6.8	-27.8	-4.8
UK	38.5	24.0	29.3	18.2	31.7	67.3	82.7	33.2	1.1	25.2	68.3	70.4	71.4	93.9	9.0
Greece	29.1	39.2	36.5	19.7	15.6	29.1	17.2	24.0	10.5	24.4					
Spain	13.4	14.6	34.2	9.1	14.6	24.8	32.4	39.7	27.4	30.4	52.6	68.7	51.9	62.8	10.3
Portugal	9.3	7.0	13.5	2.7	8.9	5.6	6.6	9.1	-8.2	8.0	14.4	38.6	25.3	18.6	9.7
Austria						32.8	37.8	34.5	18.5	29.1	27.7	35.1	27.0	22.8	
Finland						17.1	28.5	31.0	21.3	17.2	34.4	35.9	36.0	42.4	
Sweden						-4.7	-5.6	12.3	-35.0	-9.3	2.3	23.8	-13.1	-14.3	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 11.2	Average family farm income of specialised pig farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	19.6	36.5	13.3	4.8	17.0	32.7	51.2	33.8	-2.2	23.6	62.4	41.3	13.9	12.5	-0.2
France	35.7	39.3	50.2	-2.8	11.5	34.7	66.8	64.0	-17.0	-4.5	37.0	74.1	7.8	11.6	-2.6
Italy	85.4	89.9	179.9	71.9	65.6	127.3	123.1	189.9	90.3	87.7	140.6	141.6	*272.4*	*509.7*	10.0
Belgium	61.0	82.4	32.1	25.4	45.4	65.1	115.8	47.9	-14.6	56.9	89.2	80.8	31.2	26.1	-2.4
Netherlands	44.7	62.5	18.9	-17.6	21.0	34.8	77.8	74.1	-65.4	-10.3	55.9	20.0	-23.6	-17.6	
Denmark	26.9	59.5	21.2	5.0	36.4	48.7	76.6	75.2	-48.3	3.9	98.2	105.8	-13.7	-42.5	-7.4
UK	32.5	22.0	36.7	10.1	26.6	75.4	58.4	21.2	-42.2	1.3	44.7	36.5	26.1	38.4	1.0
Spain	14.1	14.7	37.6	9.9	29.7	29.2	37.5	42.9	20.7	26.6	56.4	67.4	41.2	70.2	10.4
Portugal	8.8	7.0	14.8	2.9	10.3	5.7	4.7	13.2	-16.0	8.0	14.1		26.8		10.2
Austria						33.1	38.7	34.7	18.1	29.2	28.1	37.1	28.3	20.2	
Finland						17.3	28.5	29.4	21.3	17.3	34.1	36.6	37.1	39.7	
Sweden						-4.7	-5.6	12.3	-35.0	-9.3	2.3	23.8	-13.1	-15.5	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 12.1	Average family farm income (x €1,000) of mixed farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	16.4	18.4	10.8	11.3	18.0	22.2	29.4	23.8	11.0	21.0	29.4	22.6	13.3	11.1	0.3
France	19.1	18.0	20.2	21.1	28.9	32.9	36.1	32.4	27.0	27.1	32.4	32.0	29.8	28.7	4.2
Italy	16.6	16.5	15.5	15.1	17.5	18.3	23.5	25.0	20.3	22.3	33.9	25.5	32.5	43.3	6.9
Belgium	39.0	38.9	29.3	36.1	43.1	43.1	53.9	40.4	33.4	38.2	50.4	54.8	36.7	51.5	2.7
Luxemburg	12.2	23.6	21.9	22.7	19.3	31.0	26.3	27.6	23.3	15.8	28.0	36.4	22.9	30.8	4.1
Netherlands	31.4	29.1	18.4	9.4	30.6	29.5	38.4	42.5	-8.7	8.1	34.5	15.5	10.9	17.1	-5.3
Denmark	3.9	15.1	-3.0	1.8	11.1	12.9	24.3	19.7	-14.0	1.6	22.7	24.6	-9.6	-13.5	-19.4
Ireland	14.3	20.1	22.6	16.0	27.9	27.6	32.4	22.2	23.2	20.9	27.2	27.0	20.1	31.4	3.0
UK	22.7	24.5	31.1	34.0	39.8	55.4	44.4	22.7	12.9	15.9	19.8	13.9	24.8	40.5	0.1
Greece	8.8	10.3	9.3	10.8	10.0	10.0	11.2	11.5	11.3	11.1	13.0	12.5	15.1	13.8	3.5
Spain	8.2	8.9	14.4	14.8	15.9	17.1	21.0	20.2	21.4	24.7	32.7	26.2	36.2	37.4	11.1
Portugal	2.8	2.8	1.8	1.4	1.6	2.3	2.4	2.0	2.8	3.3	6.0	7.1	6.7	7.5	10.1
Austria						31.3	32.1	28.8	22.2	24.5	26.8	32.3	26.2	23.6	
Finland						17.6	26.3	19.1	12.8	21.5	19.5	22.0	27.9	19.9	
Sweden						-6.0	-6.3	-4.3	-20.2	-9.0	-2.3	5.3	0.0	-4.4	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Appendix 3

Tables B

Table 5.4	Price of wheat (euro per 100 kg) on specialised cereal farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	17.20	16.40	17.40	14.40	14.50	13.90	13.50	12.90	11.70	12.10	12.20	11.80	10.60	12.80	-3.3
France	16.70	16.60	16.80	13.60	13.00	13.20	13.00	12.00	10.60	10.90	10.30	11.20	9.80	11.80	-4.1
Italy	20.10	20.60	19.20	17.60	16.90	16.40	16.50	15.80	14.40	13.90	15.00	15.10	13.60	15.20	-3.1
Denmark	15.60	16.00	16.60	12.60	13.30	13.40	12.90	11.90	10.50	10.80	11.10	11.20	9.70	11.90	-3.8
Ireland	15.00	15.40	16.30	14.30	12.10	13.80	13.10	10.90	11.00	11.80	11.30	9.60	10.30	14.40	-3.0
UK	16.20	16.70	16.90	13.70	13.80	14.00	12.80	12.20	11.20	11.30	11.10	12.20	10.00	12.40	-3.6
Greece	18.50	18.10	17.20	16.80	16.20	17.50	15.80	16.30	14.40	13.60	14.30	15.30	13.10	14.70	-2.2
Spain	18.90	19.40	18.20	16.60	15.60	15.80	15.30	15.00	13.60	13.20	11.90	14.10	13.00	12.70	-3.4
Portugal	28.80	22.60	19.90	19.40	15.90	18.10	14.40	13.00	12.60	13.00	11.20	13.80	11.10	12.10	-6.3
Austria						11.90	14.20	11.60	11.60	11.80	11.70	11.80	11.80	12.30	
Finland						15.30	15.70	14.90	14.20	12.60	12.40	13.00	12.60	12.00	
Sweden							12.30	11.60	10.90	10.80	10.80	10.70	10.30	10.50	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.5	Production of wheat in kg per hectare on specialised cereal farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	6.374	6.934	6.597	6.140	6.890	6.601	7.012	7.011	6.893	7.393	6.884	7.435	6.314	6.060	0.0
France	6.617	7.152	6.554	6.815	6.792	6.583	6.920	6.753	7.891	7.419	7.408	6.718	7.591	6.097	0.0
Italy	4.705	4.843	5.027	5.485	5.073	5.088	4.970	4.678	5.328	5.147	5.217	4.993	5.274	5.172	0.6
Denmark	7.139	6.481	6.172	7.047	6.561	7.439	6.967	6.915	7.103	6.871	7.513	7.603	6.922	7.037	0.9
Ireland	8.685	7.881	7.808	7.301	8.922	8.843	8.425	8.079	7.736	8.317	9.463	10.792	8.458	7.293	0.9
UK	6.928	7.273	6.983	7.434	7.659	7.879	8.276	7.564	7.774	8.575	8.224	7.290	8.274	7.858	1.0
Greece	1.998	3.403	2.953	2.690	3.078	2.935	2.552	2.637	2.853	2.785	2.544	3.258	2.904	2.648	0.5
Spain	2.328	2.272	2.212	3.103	2.664	2.156	2.895	2.758	3.060	2.797	3.627	2.552	3.093	3.096	2.5
Portugal	1.326	2.186	1.362	1.914	2.525	1.355	1.597	1.240	1.325	1.804	2.445	1.023	2.154	1.112	-1.3
Austria						5.329	5.032	5.270	4.994	5.471	4.479	5.405	4.684	4.220	
Finland						3.965	4.568	3.744	3.403	2.464	4.413	3.920	3.593	3.776	
Sweden							6.360	5.852	5.272	5.930	5.562	5.410	5.640	5.052	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.6	Price of potatoes (euro per 100 kg) on specialised field crops farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	8.80	8.90	7.50	7.20	12.00	10.20	6.80	7.80	9.80	8.50	7.20	9.30	8.20	10.20	0.9
France	9.90	8.90	6.00	7.60	12.00	10.70	8.10	8.50	12.20	10.40	11.60	12.90	11.30	13.20	4.2
Italy	18.80	20.80	14.80	15.30	22.10	20.10	16.70	19.20	18.10	17.60	20.50	22.50	15.90	24.30	1.4
Belgium	9.80	7.60	4.00	7.80	15.40	9.80	4.90	7.40	15.50	5.90	7.20	10.10	8.70	13.90	4.3
Netherlands	11.40	10.60	7.20	9.30	15.60	13.40	8.70	9.40	16.80	9.10	9.40	13.80	12.10	14.20	3.2
Denmark	10.10	11.40	9.30	8.00	11.60	12.60	10.30	9.80	11.30	11.10	10.20	11.20	8.90	10.60	0.0
Ireland	11.60	16.90	10.00	14.40	21.90	14.20	7.40	14.20	26.10	12.20	20.60	15.00	27.10	13.50	3.7
UK	12.20	12.90	8.10	10.60	20.70	17.60	9.00	12.50	21.00	12.30	20.00	17.00	13.70	17.90	3.9
Greece	18.90	18.40	15.10	22.00	26.50	20.50	22.60	22.80	23.40	23.90	23.60	25.40	22.60	31.50	4.3
Spain	14.40	16.80	10.50	11.50	17.50	12.50	12.70	14.80	13.20	9.20	12.50	15.90	15.80	18.40	1.9
Portugal	17.60	20.10	13.10	15.40	19.90	18.30	17.50	19.10	20.90	15.80	22.40	22.80	19.00	22.50	2.4
Austria						10.90	7.50	9.10	9.70	10.60	11.30	9.70	11.30	11.60	
Finland						11.50	11.00	11.80	14.70	11.10	11.20	12.90	13.80	14.70	
Sweden							15.50	12.20	14.80	13.70	10.50	11.50	11.20	13.00	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 5.7	Production of potatoes (x 1,000 kg) per hectare on specialised field crop farms per country per year														
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**% trend**
Germany	31.2	31.4	31.5	34.8	32.3	30.1	33.3	34.0	32.4	31.4	35.3	35.2	34.2	33.2	0.8
France	29.4	32.9	34.8	35.8	33.4	35.4	34.1	37.8	38.2	39.2	36.2	35.1	37.8	37.3	1.3
Italy	25.8	26.7	28.4	27.3	23.4	27.3	26.7	25.4	25.3	26.5	29.3	30.7	29.0	21.2	0.0
Belgium	33.0	38.5	43.3	45.2	33.1	34.2	39.7	42.6	35.0	36.2	34.9	33.2	35.3	28.6	-1.7
Netherlands	40.2	40.7	40.8	42.5	40.8	41.8	43.4	46.4	34.4	45.1	45.1	38.0	36.9	35.8	-0.9
Denmark	27.5	26.7	25.7	28.0	28.4	26.1	28.3	30.6	29.0	29.2	30.8	31.4	33.2	31.8	1.9
Ireland	28.4	31.0	27.6	25.7	26.1	27.8	31.3	28.3	22.5	28.0	31.1	39.5	25.0	34.0	1.2
UK	38.3	36.3	41.7	40.3	37.7	35.7	39.0	40.7	39.2	39.7	35.5	39.7	39.9	40.8	0.3
Greece	25.7	27.0	27.2	27.2	27.0	25.5	28.1	27.8	28.3	26.5	28.0	29.5	31.0	25.8	0.8
Spain	20.8	22.4	24.1	21.4	21.6	21.5	23.4	21.4	25.2	27.6	28.3	30.2	39.3	25.3	3.5
Portugal	11.8	11.0	11.6	10.1	13.1	13.4	12.1	12.9	14.0	14.4	13.2	14.4	14.9	14.6	2.5
Austria						27.0	33.2	31.3	31.0	34.3	30.5	30.6	29.4	28.5	
Finland						25.3	23.9	26.3	22.3	26.1	28.5	27.2	27.0	23.7	
Sweden							24.8	29.0	31.9	33.0	33.3	32.0	31.8	29.9	

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 8.5	Average price of apples and pears on specialised fruit farms (euro/100 kg)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	% trend
Germany								38	35	32	28	36	41	35	
France	37	57	29	23	31	30	33	34	38	31	31	36	37	40	-0,7
Italy	36	47	33	25	29	31	33	31	27	28	25	31	34	39	-1,0
UK	75		57	50	59	54	53	68	79	68	71	78	99	69	2,0
Greece	29	48	29	30	34	35	29	32	33	36	30	40	39	44	1,4
Spain	29	33	40	30	38	32	22	21	25	21	23	23	28	28	-2,3
Portugal	49	36	38	38	38	37	38	27	40	33	40	44	51	79	3,1

Source: FADN-CCE-DG Agri; adaptation by LEI.

Table 8.6	Average price of oranges on specialised fruit farms (euro/100 kg)														
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	% trend
Italy	24	27	23	19	24	20	23	22	23	23	25	23	24	26	-0,2
Greece	18	18	16	18	20	20	16	14	12	13	19	23	22	22	2,3
Spain	20	20	17	16	18	19	22	21	19	22	20	20	20	21	0,7
Portugal	51	53	38	38	33	40	48	40	24	32	27	30	22	25	-5,4

Source: FADN-CCE-DG Agri; adaptation by LEI.

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